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FROM THE

UNITED STATES GOVERNMENT

H. O. No. 166

PACIFIC ISLANDS PILOT

Volume II

(EASTERN GROUPS)

U.S.

PUBLISHED BY THE HYDROGRAPHIC OFFICE
UNDER THE AUTHORITY OF THE
SECRETARY OF THE NAVY

WASHINGTON
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1916

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H. O. No. 166.

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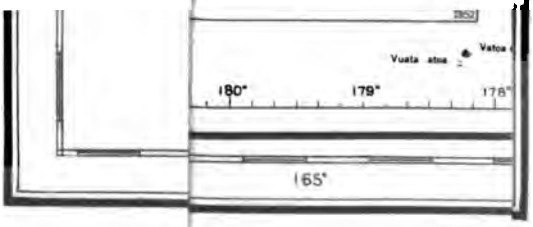
2852
Vatoa
Vuata atoa
180°
179°
178°
165°

PREFACE.

This publication comprises the sailing directions for the Cook, Tubuai, and Society Islands, Tuamotu Archipelago, Marquesas, Tonga, Samoa, Fiji, Union, Ellice, Phoenix, Gilbert, and scattered islands lying to the northward of this region known as the Line Islands. It cancels all Notices to Mariners up to and including No. 52, of 1915.

The information contained in this work has been compiled principally from British Admiralty publications and from reports furnished this office by consular officials, the officers of the Navy, and merchant marine.

The bearings and courses are true and are given in degrees, from 0° to 360°, commencing at north and increasing to the right, in accordance with the system adopted by the United States Navy.

Bearings limiting sectors of lights are toward the light.

The directions of winds refer to the points from which they blow; of currents, the points toward which they set. These directions are true.

Variations, with the annual rate of change, may be obtained from H. O. chart No. 2406, Variation of the Compass.

Distances are expressed in nautical miles, the mile being approximately 2,000 yards.

Soundings are referred to low water ordinary springs.

Heights are referred to high water ordinary springs.

The latest information regarding lights, their characteristics, sectors, fog signals, and submarine bells should always be sought in the light lists.

Attention is invited to the coupons on the first page of this book, which entitle the purchaser to a summary of the Notices to Mariners affecting this publication. They will be ready for distribution as soon as practicable after the first of each year, beginning January, 1917.

Mariners are requested to notify the United States Hydrographic Office, directly or through one of its branch offices, of any new information obtained, or of any errors or omissions discovered in this publication.

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GLOSSARY.

A short vocabulary of Polynesian dialects.[1]

English.	Marquesas.	Tahiti.	Rarotonga.	Manahiki.	Samoa.	Niuē.	Fakaofu.	Tonga.	Fiji (Mbau).	Rotumah.
Ant	Ko	Ro	Lo	Loa	Loi	Lo	Lo	Lo	Ngkasikalolo	Tuitui.
Arm	Iima	Rima	Lima	Lima	Lima	Lima	Lima	Nima	Lingana	Siu.
Arrow	Koniu	Ohe			U	Fana		Kaho	Ngasau	Fana.
Bad	Pe	Ino	Kino	Kino	Leanga	Kelea	Leanga	Kovi	Tha	Rahsa.
Banana	Meika	Mei'a	Meka		Fa'i	Futi		Hopa	Vundi	Per.
Black	Panu	Ereere	Uliuli	Uriuri	Uriuri	Menauli	Uriuri	Ulfuli	Loaloa	Kel.
Body	Tino	Tino	Kopopa	Tino	Tino	Tino	Tino	Jino	Yangona	Thoro.
Boy	Mahai	Tama iti	Tama iti	Tama iti	Tama	Tama	Tama	Tama	Ngone tangane	Lea lilii.
Bow	Pana	Fana			Aufana	Kaufana		Kaufana	Ndakai	Loloki.
Bread fruit	Me	Uru	Kulu		Ulu	Me		Mei	Ut	Ul.
Breathe		Huti te ahe	A'o	Manava	Manava	Manava	Manava	Manava	Thengu	Huang.
Brother	Tuaana	Tuaane	Teina	Teina	Uso	Mata Keinauga	Teina	Uho	Tuakana	Sosingi.
Canoe	Vaka	Vaa	Vaka	Vaka	Va'a	Vaka	Vaka	Vaka	Wanka	Tafang.
Chief	Hakaiki	Raatira	Ariki	Ariki	Alii	Iki	Aliki	Eiki	Turanga	Ngangats.
Club	Akau toa	Raau	Lupo	Tuki	Uatongi	Lakau		Akau	Ai vau	Oipelong.
Cloud	Ao	Ata	Ao	Ao	Ao	Aho	Ao	Ao	O	Aonga.
Coconut	Eehi	Haari	Niu	Ni	Niu	Niu	Niu	Niu	Niu	Niu.
Cold	Anu	Maariri	Anu	Makariri	Ma'alili	Makalili	Ma'alili	Mokojia	Liliwa	Matit.
Come	Amai	Haere mai	Tae	Haere mai	Sau	Hau	Sau	Hau	Lako mai	Leum.
Darkness	Potana	Poiri	Pouri	Pouri	Pouriuri	Pouriuri	Po	Fakapouri	Butobuto	Mahsun.
Day	Ao	Ao	La	Ao	Ao	Aho	Ao	Aho	Singa	Terundie.
Daughter	Moi	Tama hine	Tama ine	Tama iti vahine.	Afafine	Tama fifine	Afafine	Ofifine	Luvenalewa	Ata le'ehaina.
Die	Mate	Pohe	Máte	Mate	Oti	Mate	Mate	Mate	Mate	Akia.
Distant	Memae	Teatea e	Mamao	Mamao	Mamao	Mamao	Mamao	Mamao	Yawa	Souson pao.
Dog	Nuhe	Uri	Mango		Uri			Kuri	Koli	Kam hir.
Drink	Inu	Inu	Inu	Inu	Inu	Inu	Inu	Inu	Ngunu	Iom.
Ear	Buaina	Tari'a	Taringa	Taringa	Taringa	Telinga	Talinga	Telinga	Ndalingana	Falinga.
East		Te hitia o te ra			Sasae	Tokilau		Hahake	Thake	

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[1] G. Turner, LL. D., London Missionary Society, 1884.

A short vocabulary of Polynesian dialects—Continued.

English.	Marquesas.	Tahiti.	Rarotonga.	Manahiki.	Samoa.	Niuē.	Fakaofu.	Tonga.	Fiji (Mbau).	Rotumah.
Eat	Kai	Amu	Kai	Kai	'Ai	Kai	Kai	Kai	Kana	Ate.
Eye	Mata	Mata	Mata	Mata	Mata	Mata	Mata	Mata	Mata	Math.
Father	Motua	Metua tane	Metua tane	Metua tane	Tama	Matua	Tama	Tamai	Tamana	Otha.
Fear	Meta'u	Mata'u	Mataku	Mataku	Fefe	Matakutaku	Mataku	Manavahe	Rere	Fea.
Female	Vahine	Ufa	Vaine	Vahine	Fafine	Fifine	Fafine	Fefine	Alewa	Hoien.
Fire	Ahi	Auahi	A'i	Ahi	Afi	Afi	Afi	Afi	Bukawanga	Reh.
Fish	Ika	I'a	Ika	Ika	I'a	Ika	Ika	Ika	Ika	I'e.
Fowl	Moa	Moa	Moa	Moa	Moa		Moa	Moa	Toa	Moa.
Girl	Pahoe	Tama hine	Tama ine	Tama iti hika	Teine	Tama fifine	Teine	Ta'ahine	Ngonealewa	Lehaina.
Give	Vaiei	Hopoi	Oatu	Kave	Foa'i	Foaki	Foaki	Foaki	Solia	Naf.
Go	Ile'e	Haere	Aere	Hano	Alu	Fano	Alu	Alu	Lako	La'o.
Good	Meitai	Maita'i	Meitaki	Esumalie	Lelei	Mitaki	Lelei	Lelei	Vinaka	Lele.
Great	Nui	Rahi	Mata	Rahi	Tele	Lahi	Tele	Lahi	Levu	Tiu.
Hair	Ouoho	Rouulu	Lauulu	Lauulu	Lauulu	Lauulu	Lauulu	Lauulu	Ndrauniuluna	Leva.
Head	Upoko	Upoo	Mimiti	Ulu	Ulu	Ulu	Ulu	Ulu	Uluna	Filou.
Hear	Hakaono	Fa'aro'o	Akalongo	Langona	Fa'alongo	Fanongonongo	Fakalongo	Fanongo	Rongotha	Thaliung.
Heat	Vea	Mahanahana	Ma'ana	Vevela	Vevela	Mafana	Vevela	Mafana	Katakata	Pumahan.
Heavens	Ani	Ra'i	Langi	Langi	Langi	Langi	Langi	Langi	Loma Langi	Lang.
House	Fae	Fare	Ara	Fare	Fale	Fale	Fale	Fale	Vale	Ri.
Know	Ite	Ite	Kite	Itea	Iloa	Iloa	Iloa	Iloi	Kila	Mi atama.
Land	Fenua	Fenua	Enua	Henua	Fanua	Fonua	Fenua	Fenua	Vanua	Hanua.
Laugh	Ata	Ata	Kata	Kata	Ata'ata	Kata	Kata	Kata kata	Drendre	Kaha.
Leg	Vae	Avae	Vaevae	Vae	Vae	Hui	Vae	Vae	Yavana	La.
Light	Maama	Maramarama	Ao	Malamalama	Malamalama	Mama	Ao	Mama	Rarama	Tafa.
Lightning	Uia	Uira	Uila	Uira	Uila	Uhila	Uila	Uhila	Liva liva	Mere.
Live	Pohoe	Ora	Ola	Ola	Ola	Moui	Ola	Moui	Bula	Mauri.
Make	Pepena	Hamani	Angaanga	Fau	Fai	Eke	Fai	Ngaohi	Thakava	Re.
Male	Ahana	Oni	Tane	Tane	Tane	Tane	Tane	Taane	Tangane	Tha.
Man	Enata	Tane	Tangata	Tangata	Tangata	Tangata	Tangata	Tangata	Tamata	Tha.
Moon	Mahina	Ava'e	Malama	Marama	Masina	Mahina	Masina	Mahina	Vula	Hual.
Mouth	Fafa	Vaha	Ngutu	Ngutu	Ngutu	Ngutu	Ngutu	Ngutu	Ngusuna	Nuts.
Mountain	Mauna	Mau'a	Maunga	Maunga	Maunga	Mounga	Mounga	Mounga	Ulunivanua	Solo.
New	Hou	Opi	Ou	Fou	Fou	Fou	Fou	Fau	Vou	Fo'ou.
Night	Po	Po	Po	Po	Po	Po	Po	Pouri	Bongi	Pong.
North		Apato'a			Matu			Tokelau	Vualiku	
Nose	Ihu	Ihu	Uatangiu	Isu	Isu	Ihu	Isu	Ihu	Uthuna	Is.
Old	Ka'kiu	Tahito	Tamiriatu	Tahito	Tuai	Popo	Leva	Tuai	Makawa	Mathua.
Place	Tu'u	Tu'u	Tuku	Tuku	Tu'u	Tuku	Tuku	Tuku	Viria (verb)	Nasua.
Pig	Puaka	Pua'a	Puaka		Pua'a	Puaka		Puaka	Vuaka	Puak.
Rat	Kioe	Iore	Kiore	Kiore	Imoa	Kuma	Kimoa	Kuma	Kalavo	Pitsa.
Rain	Ua	Ua	Ua	Ua	Ua	Uha	Ua	Uha	Utha	Uas.
Red	Veakiki	Uraura	Mulamula	Kukura	Mumu	Nakula	Mumu	Kulakula	Damudamu	Mia.
Sand	Onetai	One	One	One	Oneone	Oneone	Oneone	Oneone	Nukunuku	Thanthan.
Ship	Ihepe	Pahi	Pai	Pahi	Va papa longi	Vaka tonga	Folau taua	Vaka papa langi.	Wanka levu	Ahoi.

Sit	Noho	Noho	No'o	Noho	Nofo	Nofo	Nofo	Nofo	Tiko	Noh.
See	Tiohi	Ite	Akalu	Tito tiro	Vaai	Kikite	Vaai	Vakai	Raitha	Iosete.
Son	Tama	Tama iti	Tama	Tama	Atalii	Tama tane	Atalii	Foha	Luvena	Le'e.
South		Apato'erau			Tonga	Malangai		Potutonga	Theva	
Spear	Pa'eo	Mahae	Tao	Tao	Tao	Tao	Tao	Tao	Moto	Tsao.
Stone	Kea	O fai	Toka	Fatu	Ma'a	Ma' a	Fatu	Ma' a	Vatu	Hotk.
Star	Fetu	Feti'a	Etu	Fetu	Fetu	Fetu	Fetu	Fetu	Kalokalo	Heth.
Sea	Tai	Miti	Tai	Tai	Sami	Tahi	Moana	Tahi	Waitui	Sas.
Sun	Oumati	Ra	La	La	La	La	La	La'a	Singa	Asth.
Sugar cane	To	To	To		Tolo	To		To	Ndovu	Thou.
Small	Iti	It	Ngiti	Iti	Itiiti	Tote	Itiiti	I' i	Lailai	Me'a.
Taro	Tao	Taro	Taro		Talo	Talo	Talo	Taro	Ndalo	Au.
Teeth	Niho	Niho	Ni'o	Niho	Nifo	Nifo	Nifo	Nifo	Batina	Al.
They	Atou	Ratou	Latau	Latau	Latau	Lautolu	Latau	Nautolu	Ko ira	Iris.
Think	Metao	Mana'o	Ma'ara	Maharahara	Manatu	Manamanatu	Manatu	Manatu	Nanuma	Aahai.
Thunder	Fatutii	Patiri	Mangungu	Faititiri	Faititili	Paku le langi	Faititili	Faijijili	Kurukuru	Thu.
Tongue	Eeo	Arero	Alelo	Alelo	Alelo	Alelo	Alelo	Elelo	Yamena	Alel.
Tree	Akau	Raau	Rakau	Lakau	La'au	Lakau	Lakau	Akau	Kau	Ol.
Water	Vai	Vai	Vai	Vai	Vai	Vai	Vai	Vai	Wai	Vol.
West		Te hitia o ter a			Sisifo	Mahifohifo		Hikifo	Ra	
Weep	Eue	Ta i	Aue	Tangi	Tangi	Tangi	Tangi	Tangi	Tangi	Ou.
White	Maaita	Uouo	Teatea	Tea	Sinasina	Hina	Sinasina	Hinehina	Vulavula	Fis.
Wind	Matani	Mata'i	Matangi	Matangi	Matangi	Matangi	Matangi	Matangi	Thangi	Lang.
Yam	Buauhi	Uhi	Ui		Ufi	Ufi		Ufi	Uvi	Uk.
One	Tahi	Thai	Ta'i	Tahi	Tasi	Taha	Tasi	Taha	Ndua	Ta.
Two	Ua	Rua	Rua	Lua	Lua	Uo	Lua	Ua	Rua	Rua.
Three	Tou	Toru	Toru	Toru	Tolu	Tolu	Tolu	Tolu	Tolu	Thol.
Four	Fa	Ha	A	Fa	Fa	Fa	Fa	Fa	Va	Hak.
Five	Ima	Bima	Rima	Lima	Lima	Lima	Lima	Nima	Lima	Lium.
Six	Ono	Ono	Ono	Ono	Ono	Ono	Ono	Ono	Ono	On.
Seven	Fitu	Hitu	Itu	Hitu	Fitu	Fitu	Fitu	Fitu	Vitu	Hith.
Eight	Vau	Varu	Valu	Varu	Valu	Valu	Valu	Valu	Walu	Vol.
Nine	Iva	Iva	Iva	Iva	Iva	Iva	Iva	Hiva	Thiwa	Siar.
Ten	Onohu'a	Ahura	Ngaulu	Laungahulu	Sefulu	Hongofulu	Sefulu	Hongafulu	Tini	Sanghul.
Twenty	Eua onohuu	Ta'au	Elua ngaulu	Takau	Luafulu	Ua hongofulu	Luafulu	Luofulu	Ruasangavulu	
Hundred	Au	Rau	Lau	Lima takau	Selau	Te au	Selau	Te au	Duanandrau	Talau.
Thousand	Mano	Mano	Mano	Ua lau	Afe	Afe	Afe	Afe	Undolu	Afe..

A short vocabulary of Polynesian dialects—Continued.

English.	Gilbert Islands.	Fotuna (Horne Islands).	Niué.
Able; to be	Kona; koná	Mafai; lavā	Maeke; mafai.
Adze	Tanai; kabao		Toki-talai.
Arrow	Kai ni katake	Ngasa-ū	Fana.
Axe	Ai; waitebu; angara	Toki; tipi	Toki.
Bad	Buakaka; be; yowawa	Veli; kino	Kelea.
Bamboo	Kai-bába	Kofe	Kofe; vā.
Banana	Butsi	Futi	Futi; lau-malika.
Bay or harbor	Namo; Manoku; rabi	Taulanga; fanga	Ava.
Black	Roro; kun; bata	Uli-uli	Uli; uli-mangia; kiva.
Bow	Kati; kai-ni katebe	Fana	Kau-fana.
Boy	Ataci-ni-mane; tei-nomane.	Tama-liki-suli	Tama-tane.
Brother	Tei; tari	Tei	Matakainanga; tehina.
Breadfruit	Mai	Mei; kuta	Mei.
Breeze	Ang-riki	Savili	Havili.
Bullock	Bun-ni-kao-mane; kaobun.	Pi pi	Tama-povi-tane; Punuapovi-tane.
Calamity		Mala	
Canoe	Wa; baurua	Vaka	Vaka.
Channel	Rawa	Ava	Ava.
Chief	Taka; mata-ni-wi	Matapule; kaifa-kaulu; sau.	Patu; iki.
Chisel	Toki	Toki	Tofi.
Cloud	Nang; nang-koto	Ao	Aolu; ao-langi.
Cook, to			
Club	Bati raku; mbo	Kanava	Katoua; pelu; kanava akau.
Club, to	Oro		Tuki.
Cocoa-nut	Ni	Niu	Niu.
Cool	Maitoro		Hauhau.
Cold	Mariri	Makalili	Makalili.
Copra	Taka-taka	Popo	Popo.
Come, to	Mai; ki-mai; roko	Mai; te-mai; ngai-mai	Hau; haele-mai.
Cut, to	Tebu	Tipi	Tipi; hele.
Dark	Ro-tongitong; ro	Pouli	Pouli-kiki.
Dart, a	Koro	Ti'a	Tika.
Day	Ngaina	Aso	Aho.
Die, to	Mate	Mate; feluku	Mate.
Distant	Raroa; tawarwae; kaka; kira-roa.	Mamao; alingalinga	Mamao.
Dog	Kiri; kamea	Kuli	Kuli.
Eat, to	Amarake; matam kaikai; kana; kang.	Kai	Kai; taumafa.
Egg	Bunatoi	Fua-moa	Tufua-manu.
Evening	Airo; tai-riki; pungitai.	'Afi-afi	'Afi-afi.
Exchange	Ioki; iokina; bobai; kabobai.	Soko; faka-tau	Faka-tau; fehikitaki.
Eye	Mata	Mata	Mata.
Father	Tama	Tama	Matua-tane.
Fear, to	Maka; beru; were	Mataka; lika	Matatakutaku.
Fire	A'i	Afi	Afi.
Fish	Ika	Ika	Ika.
Foreigner	Janena; iruwa; i-matang.	Folau; papalangi; tangata-kese.	Tangata-kehe; papalangi.
Fowl	Moa	Moa	Moa.
Fruit	Uā	Fua	Fua.
Girl	Ataci-na-ine; teinaine	Taine; teine	Tama-fifine.
Give, to	Anga; ka-mai; ngka	Au-mai; soli	Foaki; ta-mai.
Go, to	Ke; ki-nako; ri	Lalao; nake; ano; saele	Fano; 'o.
Good	Roie; raoiroi; rerei	Malie; lelei	Mitaki.
Great	Ababaki; wari; bubura; bubera.	Lasi; vosa	Lahi.
Head	Atsu	Puso; ulu	ulu.
Hear, to	'Ongo; 'ongora	Longo	Fa-nongonongo longona
Hew, to	Tebu	Pala	Tūtū.
Hill	Maunga; tabuki	Puke; maunga	Matike tike.
High	Rietáta; rineieta		Toko-lunga.
Hot	Buebue; kabue	Pusa; vela; mofi	Vela; vevela.
House	Uma; bata; maniap	Fale	Fale.
Iron	Biti; bits; waro	Uka-mea; fao'	Lapa-toa.
Island	Aba makoro	Motu	Motu; nuku.
King	Uea	Aliki	Patu-iki.
Knife	Waro; taba	Sele	Titipi.
Know, to	Ata	Iloa	Iloa.
Lagoon	Nama	Namo	Loto; loloto.
Land	Aba; tano	Fenua	Kelekele.
Leg	Wae	Vae	Hui.
Lie, to	Kewe; warau	Loi; loisi	Pipopiko.
Light	'Ota	Kanakana; malama	Ma'ama.
Lightning	Iti	Uila	Uhila; lupa.
Live, to	Maiu	Mauli	Mouli; moui; óla.
Make (causative prefix)	Ka	Faka	Faka.
Make (create)	Karika; karaoa	Langa; fai	Eke.

A short vocabulary of Polynesian dialects—Continued.

English.	Gilbert Islands.	Fotuna (Horne Islands).	Niué.
Man	A'omata; man; mane	Tangata; tane-male	Tangata; tane.
Many	Maiti; banao; wano; bati.	Ngate; toka mauke; api.	Langa; tokolonga.
Mast	Aneang	Faná	Fana.
Moon	Namakaina	Masina; malama	Mahina.
Morning	Inga-rō; ai-ota	Usu; pongipongi	Pongipongi.
Mother	Tinā; tinana	Tinana	Matua-fifine.
Mountain	Maunga; ta-buki	Maunga	Mounga.
New	Menai; ngkanaiba; waeai.	Foou	Fou.
Night	Bong	Pō	Pō.
No	Kakea; tiaki	Lé; leai; esi	Nakai.
Ocean	Maráwa	Moána	Tahi; moána.
Old (of persons)	Kāra; un	Matua	Motua; fua-kau.
Old (of things)	Nikawai; ngkoangkoa	Vilu; tuai; mango; matuu.	Leva.
Paddle		Fo'e	Fohe.
Pandanus tree	Kaina	Fala; kiekie	Fala.
Parent	Karo	Matua	Matua.
Pig	Motomoto; beki	Puaka; mō	Puaka.
Place (locality)	Tabo; ne	Fasi	Mena; fahi.
Place, to	Kaki; ka-tiku; ka-mina.	Tuku	Tuku.
Plantation	Ne-n-aroka; unika	Kainga	Kaina.
Rain	Karau; timtim	Ua; afuafu	Uha.
Rainbow	Nei-wirara		Tangaloa.
Rat	Kimoa	Kuma	Kumā.
Red	Uraura; am; babobo	Kula; memelo	Kula.
Reef	Arora; atsi-mane; rakai; rakau.	Tete; tua-akau; 'akau	Ulu-ulu.
River	Karanga	Vai-tafe; liwa	Vai-lele.
Rope	Maca; ro	Maca; taula	Toua.
Sail, a	'Ie	Lá	Lá.
Sand	Bike	One	Oneone.
Sea	Tari	Tai; vasa; moāna	Tahi; moana.
See, to	Karo; nora; no	Kiloa; kite; mamata; tio	Kite; kitia.
Shark	Bakoa; tababa; anoi; urunga.	'Anga; tanifa	Mangō.
Ship	Kai-buke; wa-nimatang	Vaka-papalangi; paopao.	Faulua; vaka-tonga.
Shoot, to	Katea; katebe; katia		Fána.
Sin	Bure	Anga-sála	Hála.
Sit, to	Tekateka; tero; toro	Nofo	Nofo.
Sleep, to	Mwe; matu; kiro	Mo'e	Mohe.
Sling, a	Bana	Maka-maka	Maka.
Small	Riki; karako; ua-ngingi.	Mou; tou; liki; toe-toe.	Tote.
Speak, to	Taku; taka; taetae	Faki; muna	Vanga-hau; tala-hau.
Spear	Tara; unun; maran	Tao	Uaki; huki; tao.
Steal, to	Kimoa; ira; kira; kanawaru.	Kaia'a	Kaiha; fofo.
Stone	Atsibu; atsi	Fatu; kiva	Maka.
Storm	Ang-nenea; angbaibati	Asiosio; timu; milomilo.	'Afā hiohio.
Sugar cane	Kai-karewe	Tolo	Tō; lau-leleva.
Sun	Tai	La	Lā.
Taro	Tao; tao-roro; babai; ati-mainiku.	Mongi; pulaka; talo	Talo.
Think, to	Jango; taku	Manatu; sakana	Manatu.
Thunder	Ba; ingu; rebrerebwe	Mana; ngulu-ngulu	Paku-langi.
Tree	Kai	Lakau	'Akau.
True	Koaua; bon; koau	Maoki; tonu	Moli.
Turtle	'On; tabaki	Fonu	Fonu.
Water	Ran; mam	Vai	Vai.
Whale	Kua; 'ato	Tafola	Tafuā; taufuā.
White	Ma-'ina'ina; māi	Tea; sina	Hina; tea; vake.
Wind	Ang	Matangi	Matangi.
Woman	Aine	Fafine	Fifine.
Wood	Kai	Kau	'Akau.
Work	Beka; makuri	Ngaoi	Ngahua.
Yam	Boto	Ufi; soi	Ufi; hoi.
Yellow	Meamea	Kelokelo; felofilo	Angoango.
Yes	Ai! engi	I; io; eo; Io-mo!	E!
PRONOUNS.			
I	Ngai; i; n	Kau; a'u; kita	Au.
Thou	Ko; ngkoe	Koe	Koe.
He; she	Teu; nei; ngaia	Ia	Ia.
We (inclusive)	Ra; ira	Tatou	Tau-tolu.
We (exclusive)	Ti	Matou; motou	Mautolu.
Ye	Ngkomi; kem; am; imi	Koutou; kotou	Mutolu.
They	I'a	Latou; lotou	Lau-tolu.
My; mine	Au; —u	Laku; lakita; naku; noku.	Hoku; kaku.
Thy; thine	Am; —m	La'au; sa'au; na'au	Hō; hoū.
His; hers	Ana; —n; —na	Lana; lona; sana; nona	Hana.

A short vocabulary of Polynesian dialects—Continued.

English.	Gilbert Islands.	Fotuna (Horne Islands).	Niué.
PRONOUNS—Contd.			
Our (inclusive)	Ara; —ra	Lata; lota; sota; na-ata	Ha tautolu.
Our (exclusive)	Ara; —ra	Lāma; sāma; na-matou.	Ha mautolu.
Your	Ami; —mi	La-kotou; sa-kotou; no-kotou.	Ha-mulu; ho mutolu.
Their	Aia; —i'a	La-latou; sa-latou; no-latou.	Ha-lautolu.
NUMERALS.			
One	Te; teaina; te-uana	Tasi	Taha.
Two	'Ua	Lua	Ua.
Three	Ten; teni	Tolu	Tolu.
Four	Ā; ā-ua	Fā	Fā.
Five	Nima; nima-ua	Lima	Lima.
Six	Ono; ono-ua	Ono	Ono.
Seven	Itu; iti	Fitu	Fitu.
Eight	Wan	Valu	Valu.
Nine	Rua	'Iva	Hiva.
Ten	Ngaun; bwi; bui	Se-fulu; nga-fulu	Hongo-fulu.
Twenty	'Ua-ngaun	Lua-sefulu	'Ua-fulu.
Hundred	Bubua	Se-lau	Te-'au; au.
Thousand	Ngā	Afe	Afe.
POINTS OF COMPASS.			
North	Meang	Tokelau	Tokelau; fahi-tokelau.
South	Maiaki; aiaki	Mulikeu	Fahi-tonga.
East	Mainiku; tanrake	Mata-fenua; sasake	Fahi-uta.
West	Maiao; tan-rio	Sisifo	Fahi-lalo.

INFORMATION RELATING TO NAVIGATIONAL AIDS AND GENERAL NAVIGATION.

THE CORRECTION OF CHARTS, LIGHT LISTS, AND SAILING DIRECTIONS.

The following publications are issued by the United States Hydrographic Office as guides to navigation: Charts, Chart Catalogues, Sailing Directions, Light Lists, Tide Tables, Notices to Mariners, Pilot Charts, and Hydrographic Bulletins. Of these, the Notices to Mariners and the Hydrographic Bulletins are free to mariners and others interested in shipping. The Pilot Charts are free to contributors of professional information, but are sold to the general public at 10 cents a copy. The other publications of the office are sold under the law at cost price.

The Charts, the Sailing Directions, and the Light Lists are all affected by continual changes and alterations, concerning which information from all parts of the world is published weekly in the Notices to Mariners.

The charts are always corrected for all available information up to the date of issue stamped upon them; and the Light Lists should be noted for the recent alterations and additions. The Sailing Directions, however, can not, from their nature, be so fully corrected, and in all cases where they differ from the charts, the charts must be taken as the guide.

Charts.—When issued from the Hydrographic Office, the charts have received all necessary corrections to date.

All small but important corrections that can be made by hand are given in the Notices to Mariners, and should at once be placed on the charts to which they refer.

Extensive corrections that can not be conveniently thus made are put upon the plates, and new copies are put on sale. Masters of vessels are urged to replace the old charts, which should be destroyed to prevent the possibility of their being used in the navigation of the ship.

The dates on which extensive corrections are made are noted on the chart on the right of the middle of the lower edge; those of the smaller corrections at the left lower corners.

The edition, and corresponding date, of the chart will be found in the right lower corner, outside the outer neat line.

In all cases of quotations of charts, these dates of corrections should be given, as well as the number of the chart (found in the lower right and upper left corners), in order that the edition of the chart referred to may be known.

The Light Lists are corrected before issue, and all changes are published in the weekly Notices to Mariners.

The navigating officer should make notations in the tabular form in the Light Lists and paste in at the appropriate places slips from the Notices to Mariners.

The Light Lists should always be consulted as to the details of a light, as the description in the sailing directions is not complete, and may be obsolete, in consequence of changes since publication.

The Sailing Directions or Pilots are kept corrected by addenda; and subsequent to date of last addenda, they should be kept corrected by means of the Notices to Mariners. Sailing Directions issued to naval vessels carry with them an envelope containing slips of corrections up to date of issue.

Addenda are published from time to time, and contain a summary of all the information received up to date since the publication of the volume to which they refer, canceling all previous Notices to Mariners.

To enable the books to be more conveniently corrected, addenda and Notices to Mariners are printed on one side only, and two copies of the latter are issued to each naval vessel, one to be cut and the slips pasted in at the appropriate places, the other to be retained intact for reference.

To paste in the slips, as the Notices to Mariners are received, is one of the duties of the navigating officer, demanding faithful attention.

It must, however, be understood that Sailing Directions will rarely be correct in all details, and that, as already stated, when differences exist, the chart, which should be corrected from the most recent information, should be taken as the guide, for which purpose, for ordinary navigation, it is sufficient.

The Tide Tables, which are published annually by the United States Coast and Geodetic Survey, give the predicted times and heights of the high and the low waters for every day in the year at 70 of the principal ports of the world, and, through the medium of these by means of tidal differences and ratios, at a very large number of subordinate ports. The tables for the Atlantic and the Pacific coast ports of the United States are also published separately.

It should be remembered that these tables aim to give the times of high and low water, and not the times of turning of the current or of slack water, which may be quite different.

Notices to Mariners, containing fresh information pertaining to all parts of the world, are published weekly and mailed to all

United States ships in commission, Branch Hydrographic offices and agencies, and United States consulates. Copies are furnished free by the main office or by any of the branch offices on application.

With each Notice to naval vessels is sent also a separate sheet, giving the items relating to lights contained in the latest Notice, intended especially for use in correcting the Light Lists.

Pilot Charts of the North Atlantic, Central American Waters, and North Pacific and Indian Oceans are published each month, and of the South Atlantic and South Pacific Oceans each quarter. These charts give the average conditions of wind and weather, barometer, percentage of fog and gales, routes for steam and sailing vessels for the period of issue, ice, and derelicts for the preceding period, ocean currents and magnetic variation for the current year, storm tracks for preceding years, and much other useful information. They are furnished free only in exchange for marine data or observations.

Hydrographic Bulletins, published weekly, are supplemental to the Pilot Charts, and contain the latest reports of obstructions and dangers along the coast and principal ocean routes, ice, derelicts, and wreckage, reports of the use of oil to calm the sea, and other information for mariners. They are to be had free upon application.

THE USE OF CHARTS.

Accuracy of chart.—The value of a chart must manifestly depend upon the character and accuracy of the survey on which it is based, and the larger the scale of the chart the more important do these become.

To judge of a survey, its source and date, which are generally given in the title, are a good guide. Besides the changes that may have taken place since the date of the survey, in waters where sand or mud prevails, the earlier surveys were mostly made under circumstances that precluded great accuracy of detail; until a chart founded on such a survey is tested, it should be regarded with caution. It may, indeed, be said that, except in well-frequented harbors and their approaches, no surveys yet made have been so thorough as to make it certain that all dangers have been found. The number of the soundings is another method of estimating the completeness of the survey, remembering, however, that the chart is not expected to show all the soundings that were obtained. When the soundings are sparse or unevenly distributed, it may be taken for granted that the survey was not in great detail.

Large or irregular blank spaces among soundings mean that no soundings were obtained in these spots. When the surrounding soundings are deep it may fairly be assumed that in the blanks the water is also deep; but when they are shallow, or it can be seen from the rest of the chart that reefs or banks are present, such blanks should be regarded with suspicion. This is especially the case in coral regions and off rocky coasts, and it should be remembered that in waters where rocks abound it is always possible that a survey, however complete and detailed, may have failed to find every small patch or pinnacle rock.

A wide berth should therefore be given to every rocky shore or patch, and instead of considering a coast to be clear, the contrary should be assumed.

Fathom curves a caution.—Except in charts of harbors that have been surveyed in detail, the 5-fathom curve on most charts may be considered as a danger line or caution against unnecessarily approaching the shore or bank within that line, on account of the possible existence of undiscovered inequalities of the bottom, which only an elaborate detailed survey could reveal. In general surveys of coasts or of little frequented anchorages, the necessities of navigation do not demand the great expenditure of time required for so detailed a survey. It is not contemplated that ships will approach the shores in such localities without taking special precautions.

The 10-fathom curve on rocky shores is another warning, especially for ships of heavy draft.

A useful danger curve will be obtained by tracing out with a colored pencil, or ink, the line of depth next greater than the draft of the ship using the chart. For vessels drawing less than 18 feet the edge of the sanding serves as a well-marked danger line.

Charts on which no fathom curves are marked must especially be regarded with caution, as indicating that soundings were too scanty and the bottom too uneven to enable the curves to be drawn with accuracy.

Isolated soundings, shoaler than surrounding depths, should always be avoided, especially if ringed around, as it is doubtful how closely the spot may have been examined and whether the least depth has been found.

The chart on largest scale should always be used on account of its greater detail and the greater accuracy with which positions may be plotted on it.

Caution in using small-scale charts.—In approaching the land or dangerous banks, regard must always be had to the scale of the chart used. A small error in laying down a position means only yards on a large-scale chart, whereas on one of small scale the same amount of displacement means a large fraction of a mile.

Distortion of printed charts.—The paper on which charts are printed from engraved plates has to be damped. On drying distortion takes place from the inequalities of the paper, which greatly varies with different papers and the amount of the damping; but it does not affect navigation. The larger the chart the greater the amount of this distortion. It must not, however, be expected that accurate series of angles taken to different points will always exactly agree when carefully plotted on the chart, especially if the lines to objects be long.

Mercator chart.—Observed bearings are not identical with those measured on the Mercator chart (excepting only the bearings north and south, and east and west on the equator) because the line of sight, except as affected by refraction, is a straight line and lies in the plane of the great circle, while the straight line on the chart (except the meridian line) represents, not the arc of a great circle, but the loxodromic curve, or rhumb line, which on the globe is a spiral approaching but never in theory reaching the pole, or, if the direction be east and west, a circle of latitude.

The difference is not appreciable with near objects, and in ordinary navigation may be neglected. But in high latitudes, when the objects are very distant and especially when lying near east or west, the bearings must be corrected for the convergence of the meridians in order to be accurately placed on the Mercator chart, which represents the meridians as parallel.

On the polyconic chart, since a straight line represents (within the limits of 15 or 20 degrees of longitude) the arc of a great circle or the shortest distance between two points, bearings of the chart are identical with observed bearings.

The mercator projection is unsuited to surveying, for which purpose the polyconic projection is used by the Hydrographic Office and the Coast and Geodetic Survey.

Notes on charts should always be read with care, as they may give important information that can not be graphically represented.

Buoys.—Too much reliance should not be placed on buoys always maintaining their exact positions. They should therefore be regarded as warnings, and not as infallible navigational marks, especially when in exposed places and in the wintertime, and a ship's position should always, when possible, be checked by bearings or angles of fixed objects on shore.

Gas buoys.—The lights shown by gas buoys can not be implicitly relied on; the light may be altogether extinguished, or, if periodic, the apparatus may get out of order.

Whistle and bell buoys are sounded only by the action of the sea; therefore, in calm weather, they are less effective or may not sound.

Lights.—All the distances given in the Light Lists and on the charts for the visibility of lights are calculated for a height of 15 feet for the observer's eye. The effect of a greater or less height of eye can be ascertained by means of the table of distances of visibility due to height, published in the Light Lists.

The glare of a powerful light is often seen far beyond the limit of visibility of the actual rays of the light, but this must not be confounded with the true range. Refraction, too, may often cause a light to be seen farther than under ordinary circumstances.

When looking out for a light, the fact may be forgotten that aloft the range of vision is much increased. By noting a star immediately over the light a very correct bearing may be obtained from the standard compass when you lay down from aloft.

On first making a light from the bridge, by at once lowering the eye several feet and noting whether the light is made to dip, it may be determined whether the ship is on the circle of visibility corresponding with the usual height of the eye, or unexpectedly nearer the light.

The intrinsic power of a light should always be considered when expecting to make it in thick weather. A weak light is easily obscured by haze, and no dependence can be placed on its being seen.

The power of a light can be estimated by its candlepower or order, as stated in the Light Lists, and in some cases by noting how much its visibility in clear weather falls short of the range corresponding to its height. Thus, a light standing 200 feet above the sea and recorded as visible only 10 miles in clear weather, is manifestly of little brilliancy, as its height would permit it to be seen over 20 miles if of sufficient power.

Fog signals.—Sound is conveyed in a very capricious way through the atmosphere. Apart from the influence of the wind large areas of silence have been found in different directions and at different distances from the origin of sound, even in clear weather; therefore, too much confidence should not be felt as to hearing a fog signal. The apparatus, moreover, for sounding the signal often requires some time before it is in readiness to act. A fog often creeps imperceptibly toward the land, and may not be observed by the lighthouse keepers until upon them; a ship may have been for many hours in it, and approaching the land in confidence, depending on the signal, which is not sounded. When sound travels against the wind, it may be thrown upward; a man aloft might then hear it though inaudible on deck.

The submarine bell system of fog signals is much more reliable than systems transmitting sound through the air, as sound traveling in water is not subject to the same disturbing influences; the fallibility of the lighthouse keeper is, however, about the same in all systems, so that caution should be observed even by vessels equipped with submarine-bell receiving apparatus.

Submarine bells have an effective range of audibility greater than signals sounded in air, and a vessel equipped with receiving apparatus may determine the approximate bearing of the signal. These signals may be heard also on vessels not equipped with receiving apparatus by observers below the water line, but the bearing of the signal can not then be readily determined.

Vessels equipped with radio apparatus and submarine bell receivers may fix their distance from a light vessel having radio and submarine bell, utilizing the difference in velocity of sound waves of the radio and the bell. Sound travels 4,794 feet per second at 66° F. in water, and the travel of radio sound waves for practicable distances may be taken as instantaneous.

All vessels should observe the utmost caution in closing the land in fogs. The lead is the safest guide and should be faithfully used.

Tides.—A knowledge of the times of high and low water and of the amount of vertical rise and fall of the tide is of great importance in the case of vessels entering or leaving port, especially when the low water is less than or near their draft. Such knowledge is also useful at times to vessels running close along a coast, in enabling them to anticipate the effect of the tidal currents in setting them on or offshore. This is especially important in fog or thick weather.

The predicted times and heights of the high and low waters, or differences by which they may be readily obtained, are given in the Tide Tables for all the important ports of the world. The height at any intermediate time may be obtained by means of Tables 2A and 2B for most of the principal tidal stations of the United States, given in Table 1, and for the subordinate stations of Table 3 by using them as directed in the Tide Tables. The intermediate height may also be obtained by plotting the predicted times and heights of high and low water and connecting the points by a curve. Such knowledge is often useful in crossing a bar or shallow flats.

Planes of reference.[1]—The plane of reference for soundings on Hydrographic Office charts made from United States Government surveys and on Coast and Geodetic Survey charts of the Atlantic coast of the United States is mean low water; on the Pacific coast of the United States as far as the Strait of Juan Fuca, it is the mean of the lower low waters; and from Puget Sound to Alaska, the plane employed on Hydrographic Office charts is low water ordinary springs.

On most of the British Admiralty charts the plane of reference is the low water of ordinary springs; on French charts, the low water of equinoctial springs.

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[1] The distinction between "rise" and "range" of the tide should be understood. The former expression refers to the height attained above the datum plane for soundings, differing with the different planes of reference; the latter, to the difference of level between successive high and low waters.

In the case of many charts compiled from old or various sources the plane of reference may be in doubt. In such cases, or whenever not stated on the chart, the assumption that the reference plane is low water ordinary springs gives a larger margin of safety than mean low water.

Whichever plane of reference may be used for a chart it must be remembered that there are times when the tide falls below it. Low water is lower than mean low water about half the time, and when a new or full moon occurs at perigee the low water is lower than the average low water of springs. At the equinoxes the spring range is also increased on the coasts of Europe, but in some other parts of the world, and especially in the Tropics, such periodic low tides may coincide more frequently with the solstices.

Wind or a high barometer may at times cause the water to fall below even a very low plane of reference.

On coasts where there is much diurnal inequality in the tides, the amount of rise and fall can not be depended upon and additional caution is necessary.

Mean sea level.—The important fact should be remembered that the depths at half tide are practically the same for all tides, whether neaps or springs. Half tide therefore corresponds with mean sea level. This makes a very exact plane of reference, easily found, to which it would be well to refer all high and low waters.

The Tide Tables give in Table 3, for all the ports, the plane of reference to which tidal heights are referred and its distance below mean sea level.

If called on to take special soundings for the chart at a place where there is no tidal bench mark, mean sea level should be found and the plane for reductions established at the proper distance below it, as ascertained by the Tide Tables, or by observations, or in some cases, if the time be short, by estimation, the data used being made a part of the record.

Tidal streams.—In navigating coasts where the tidal range is considerable, especial caution is necessary. It should be remembered that there are indrafts to all bays and bights, although the general run of the stream may be parallel with the shore.

The turn of the tidal stream offshore is seldom coincident with the times of high and low water on the shore. In some channels the tidal stream may overrun the turn of the vertical movement of the tide by three hours, forming what is usually known as tide and half tide, the effect of which is that at high and low water by the shore the stream is running at its greatest velocity.

The effect of the tidal wave in causing currents may be illustrated by two simple cases.

(1) Where there is a small tidal basin connected with the sea by a large opening.

(2) Where there is a large tidal basin connected with the sea by a small opening.

In the first case the velocity of the current in the opening will have its maximum value when the height of the tide within is changing most rapidly, i. e., at a time about midway between high and low water. The water in the basin keeps at approximately the same level as the water outside. The flood stream corresponds with the rising and the ebb with the falling of the tide.

In the second case the velocity of the current in the opening will have its maximum value when it is high water or low water without, for then there is the greatest head of water for producing motion. The flood stream begins about three hours after low water, and the ebb stream about three hours after high water, slack water thus occurring about midway between the tides.

Along most shores not much affected by bays, tidal rivers, etc., the current usually turns soon after high water and low water.

The swiftest current in straight portions of tidal rivers is usually in the middle of the stream, but in curved portions the most rapid current is toward the outer edge of the curve, and here the water will be deepest. The pilot rule for best water is to follow the ebb tide reaches.

Countercurrents and eddies may occur near the shores of straits, especially in bights and near points. A knowledge of them is useful in order that they may be taken advantage of or avoided.

A swift current often occurs in a narrow passage connecting two large bodies of water, owing to their considerable difference of level at the same instant. The several passages between Vineyard Sound and Buzzards Bay are cases in point. In the Woods Hole passage the maximum strength of the tidal streams is at about half tide.

Tide rips are made by a rapid current setting over an irregular bottom, as at the edges of banks where the change of depth is considerable.

Current arrows on charts show only the most usual or the mean direction of a tidal stream or current; it must not be assumed that the direction of a stream will not vary from that indicated by the arrow. The rate, also, of a stream constantly varies with circumstances, and the rate given on the chart is merely the mean of those found during the survey, possibly from very few observations.

FIXING POSITION.

Sextant method.—The most accurate method available to the navigator of fixing a position relative to the shore is by plotting with a protractor, sextant angles between three well-defined objects on shore which are shown on the chart; this method, based on the "three-point problem" of geometry, should be in general use.

For its successful employment it is necessary: First, that the objects be well chosen; and, second, that the observer be skillful and rapid in his use of the sextant. The latter is only a matter of practice. Two observers are better for this method.

Near objects should be used either for bearings or angles for position in preference to distant ones, although the latter may be more prominent, as a small error in the bearing or angle or in laying it on the chart has a greater effect in misplacing the position the longer the line to be drawn.

On the other hand distant objects should be used for direction, because less affected by a small error or change of position.

The three-arm protractor or station pointer consists of a graduated brass circle with one fixed and two movable radial arms, the three beveled edges of the arms, if produced, intersecting at the exact center of the instrument. The edge of the fixed arm marks the zero of the graduation which enables the movable arms to be set at any angles with the fixed arm.

To plot a position, the two angles observed between the three selected objects are set on the instrument, which is then moved over the chart until the three beveled edges pass respectively and simultaneously through the three objects. The center of the instrument will then mark the ship's position, which may be pricked on the chart or marked with a pencil point through the center hole.

The transparent xylonite protractor is an excellent substitute for the brass instrument and in some cases preferable to it, as when, for instance, the objects angled on are so near the observer that they are more or less hidden by the circle of the instrument. The xylonite protractor also permits the laying down for simultaneous trial of a number of angles in cases of fixing important positions. Plain tracing paper may also be used if there are any suitable means of laying off the angles.

The value of a determination depends greatly on the relative positions of the objects observed. If the position sought lies on the circle passing through three objects (in which case the sum of the observed angles equals the supplement of the angle at the middle object made by lines from the other two) it will be indeterminate, as it will plot all around the circle. Such an observation is called a "revolver." An approach to this condition must be avoided. Near objects are better than distant ones, and, in general, up to 90° the larger the angles the better, remembering always that large as well as small angles may plot on or near the circle and hence be worthless. If the objects are well situated, even very small angles will give for navigating purposes a fair position, when that obtained by bearings of the same objects would be of little value.

Accuracy requires that the two angles be simultaneous. If under way and there is but one observer the angle that changes less rapidly may be observed both before and after the other angle and the proper value obtained by interpolation.

A single angle and a range of two objects give in general an excellent fix, easily obtained and plotted.

Advantages of sextant method.—In many narrow waters where the objects may yet be at some distance, as in coral harbors or narrow passages among mud banks, navigation by sextant and protractor is invaluable, as a true position can in general be obtained only by its means. Positions by bearings are too rough to depend upon, and a small error in either taking or plotting a bearing might under such circumstances put the ship ashore.

In all cases where great accuracy of position is desired, such as the fixing of a rock or shoal, or of fresh soundings or new buildings as additions to the chart, the sextant should invariably be used. In all such cases angles should be taken to several objects, the more the better; but five objects is a good number, as the four angles thus obtained not only prevent any errors, but they at once furnish a means of checking the accuracy of the chart itself. If a round of angles can be taken the observer's accuracy is also checked. In the case of ordinary soundings a third angle need be taken only occasionally; first, to check the general accuracy of the chart, as above stated; second, to make certain that the more important soundings, as at the end of a line, are correctly placed.

If communication can be had with the shore, positions may be fixed with great accuracy by occupying with theodolite or sextant two known points of the chart. The third angle of the triangle, that between the two points at the position sought, should be measured as a check.

The compass.—It is not intended that the use of the compass to fix the ship should be given up; in ordinary piloting the compass, with its companion, the pelorus, may be usefully employed for this purpose, although less accurate than the sextant.

If the accuracy of the chart is doubtful, the compass should be used in preference to the sextant.

In fixing by the compass, it should always be remembered that a position by two bearings only, like that by two angles only, is liable to error. An error may be made in taking a bearing, or in applying to it the deviation, or in laying it on the chart. A third or check bearing should, therefore, be taken of some other object, especially when near the shore or dangers. A common intersection for the three lines assures accuracy.

When the three lines do not intersect in a point, the following rule holds: If the line drawn to the middle object falls to the right of the point of intersection of the lines to the two outside objects, the position of the observer was to the right of the line to the middle object; and if it falls to the left of the intersection his position was to the left of the line. Thus it will be seen that the assumption, that the position is at the center of the triangle formed by the intersecting lines, is incorrect.

Doubling the angle on the bow.—The method of fixing by doubling the angle on the bow is invaluable. The ordinary form of it, the so-called "bow and beam bearing," the distance from the object at the latter position being the distance run between the times of taking the two bearings, gives the maximum of accuracy, and is an excellent fix for a departure, but does not insure safety, as the object observed and any dangers off it are abeam before the position is obtained.

By taking the bearings at two points and four points on the bow, a fair position is obtained before the object is passed, the distance of the latter at the second position being, as before, equal to the distance run in the interval, allowing for current. Taking afterwards the beam bearing gives, with slight additional trouble, the distance of the object when abeam; such beam bearings and distances, with the times, should be continuously recorded as fresh departures, the importance of which will be appreciated in cases of being suddenly shut in by fog.

When the first bearing is 26½° from ahead, and the second 45°, the run between bearings will equal the distance at which the object will be passed abeam.

A table of multipliers of the distance run in the interval between any two bearings of an object, the product being its distance at the time of the second bearing, is given in the Light Lists and in Bowditch.

Danger angle.—The utility of the danger angle in passing outlying rocks or dangers should not be forgotten. In employing the horizontal danger angle, however, caution is necessary, as should the chart be inaccurate, i. e., should the objects selected be not quite correctly placed, the angle taken off from it may not serve the purpose. It should not, therefore, be employed when the survey is old or manifestly imperfect.

The vertical danger angle may be conveniently used when passing elevated points of known heights, such as lighthouses, cliffs, etc. The computation of the distance corresponding to the height of the object and its angular elevation requires for small distances merely the solution of a plain right triangle; the natural cotangent of the angle multiplied by the height in feet gives the distance in feet. The convenient use of this method, however, requires tables such as those published by Capt. Lecky in his little book entitled "The Danger Angle and Offshore Distance Tables." This book very usefully extends the vertical angle method to finding a ship's position at sea by observing the angular altitude of a peak of known height and its bearing. The tables give heights up to 18,000 feet and distances up to 110 miles.

When the angles are not too large they should be observed "on and off the limb" and the index error of the sextant thus eliminated, in preference to correcting for it the single altitude. It must be remembered that in high latitudes the bearing of a distant object needs correction for the convergence of the meridians before being laid down on a Mercator chart. The correction may be found by the following formula, using the approximate position: The sine of the correction equals the product of the sine of half the difference of longitude by the sine of the middle latitude. It is applied on the equatorial side of the observed bearing and its effect is always to increase the latitude of the observer.

Soundings taken at random are of little value in fixing or checking position and may at times be misleading. In thick weather, when near or closing the land, soundings should be taken continuously and at regular intervals, and, with the character of the bottom, systematically recorded. By laying the soundings on tracing paper, according to the scale of the chart, along a line representing the track of the ship, and then moving the paper over the chart, keeping the line representing the track parallel with the course until the observed soundings agree with those of the chart, the ship's position will in general be quite well determined. This plan was suggested by Lord Kelvin, whose admirable sounding machine renders the operation of sounding possible in quite deep water, without slowing down the ship and consequent loss of time.

Pelorus.—All ships should be supplied with the means of taking accurate bearings both by night and by day. The standard compass is not always conveniently placed for the purpose; in such case a pelorus will be very useful, but the results are not as accurate as those obtained direct from the compass. The utility of such an instrument in ascertaining the change of bearing of an approaching ship should not be overlooked.

Position lines.—Among the various methods of fixing position at sea, the one which should be best understood and put to the most constant use is that employing position or Sumner lines. These lines give the most comprehensive information to the navigator with the least expenditure of labor and time. The knowledge gained is that the vessel must be somewhere on the line, provided the data used is accurate and the chronometer correct. As the information given by one line of position is not sufficient to determine the definite location of the vessel, it is necessary to cross this line by another similarly obtained, and the vessel being somewhere on both must be at their intersection. However, a single line, at times, will furnish the mariner with invaluable information; for instance, if it is directed toward the coast, it marks the bearing of a definite point on the shore, or if parallel to the coast it clearly indicates the distance off, and so will often be found useful as a course. A sounding taken at the same time with the observation will in certain conditions prove of great value in giving an approximate position on the line.

The easiest and quickest way to establish a line of position is by employing the method of Marcq St. Hilaire, as modified by the use of tables of altitude. The principle of this method is one of altitude differences, in which the observed altitude is compared with the computed altitude for a dead reckoning, or other selected position, and the difference in minutes of latitude measured toward the body along the line of its azimuth, if the observed altitude is greater than the computed altitude, and vice versa. A line drawn at right angles to the line of azimuth through the point thus determined is the position line, somewhere upon which will be found the position of the vessel. The tables of altitude obviate the computation of the altitude and thereby greatly facilitate the establishment of the line.

A position line may also be found by computing two positions for longitude with two assumed latitudes, and drawing the line between them; or by drawing to the position obtained with one latitude a line at right angles to the bearing of the body as taken from the azimuth tables.

A very accurate position can be obtained by observing two or more stars at morning or evening twilight, at which time the horizon is well defined. The position lines thus obtained will, if the bearings of the stars differ three points or more, give an excellent result. A star or planet at twilight and the sun afterward or before may be combined; also two observations of the sun with sufficient interval to admit of a considerable change of bearing. In these cases one of the lines must be moved for the run of the ship. The moon is often visible during the day and in combination with the sun gives an excellent fix.

The morning and evening twilight observations, besides their great accuracy, possess the additional advantage of greatly extending the ship's reliable reckoning beyond the limits of the ordinary day navigation, and correspondingly restricting the dead reckoning uncertainties of the night. An early morning fix in particular is often of great value. Though the same degree of accuracy as at twilight can not be expected, night observations are very valuable and should be assiduously practiced.

Piloting.—The navigator, in making his plan for entering a strange port, should give very careful previous study to the chart and sailing directions, and should select what appear to be the most suitable marks for use, also providing himself with substitutes to use in case those selected as most suitable should prove unreliable in not being recognized with absolute certainty. Channel buoys seen from a distance are difficult to identify, because their color is sometimes not easily distinguished and they may appear equally distant from the observer even though they be at widely varying distances. Ranges should be noted, if possible, and the lines drawn, both for leading through the best water in channels, and also for guarding against particular dangers; for the latter purpose safety bearings should in all cases be laid down where no suitable ranges appear to offer. The courses to be steered in entering should also be laid down and distances marked thereon. If intending to use the sextant and danger angle in passing dangers, and especially in passing between dangers, the danger circles should be plotted and regular courses planned, rather than to run haphazard by the indications of the angle alone, with the possible trouble from bad steering at critical points.

The ship's position should not be allowed to be in doubt at any time, even in entering ports considered safe and easy of access, and should be constantly checked, continuing to use for this purpose those marks concerning which there can be no doubt until others are unmistakably identified.

The ship should ordinarily steer exact courses and follow an exact line, as planned from the chart, changing course at precise points, and, where the distances are considerable, her position on the line should be checked at frequent intervals. This is desirable even where it may seem unnecessary for safety, because if running by the eye alone and the ship's exact position be immediately required, as in a sudden fog or squall, fixing at that particular moment may be attended with difficulty.

The habit of running exact courses with precise changes of course will be found most useful when it is desired to enter port or pass through inclosed waters during fog by means of the buoys; here safety demands that the buoys be made successively, to do which requires, if the fog be dense, very accurate courses and careful attention to the times, the speed of the ship, and the set of the current; failure to make a buoy as expected leaves, as a rule, no safe alternative but to anchor at once, with perhaps a consequent serious loss of time.

In passing between dangers where there are no suitable leading marks, as, for instance, between two islands or an island and the main shore, with dangers extending from both, a mid-channel course may be steered by the eye alone with great accuracy, as the eye is able to estimate very closely the direction midway between visible objects.

In piloting among coral reefs or banks, a time should be chosen when the sun will be astern, conning the vessel from aloft or from an elevated position forward. The line of demarcation between the deep water and the edges of the shoals, which generally show as green patches, is indicated with surprising clearness. This method is of frequent application in the numerous passages of the Florida Keys.

Changes of course should in general be made by exact amounts, naming the new course or the amount of the change desired, rather than by ordering the helm to be put over and then steadying when on the desired heading, with the possibility of the attention being diverted and so of forgetting in the meantime, as may happen, that the ship is still swinging. The helmsman, knowing just what is desired and the amount of the change to be made, is thus enabled to act more intelligently and to avoid bad steering, which in narrow channels is a very positive source of danger.

Coast piloting involves the same principles and requires that the ship's position be continuously determined or checked as the landmarks are passed. On well-surveyed coasts there is a great advantage in keeping near the land, thus holding on to the marks and the soundings, and thereby knowing at all times the positions rather than keeping offshore and losing the marks, with the necessity of again making the land from vague positions, and perhaps the added inconvenience of fog or bad weather, involving a serious loss of time and fuel.

The route should be planned for normal conditions of weather, with suitable variations where necessary in case of fog or bad weather or making points at night, the courses and distances, in case of regular runs over the same route, being entered in a notebook for ready reference, as well as laid down on the chart. The danger circles for either the horizontal or the vertical danger angles should be plotted, wherever the method can be usefully employed, and the angles marked thereon; many a mile may thus be saved in rounding dangerous points with no sacrifice in safety. Ranges should also be marked in, where useful for position or for safety, and also to use in checking the deviation of the compass by comparing in crossing, the compass bearing of the range with its magnetic bearing, as given by the chart.

Changes of course will in general be made with mark or object abeam, the position (a new "departure") being then, as a rule, best and most easily obtained. The pelorus should be at all times in readiness for use, and the chart where it may be readily consulted by the officer of the watch. The sextant should also be kept conveniently at hand.

A continuous record of the progress of the ship should be kept by the officer of the watch, the time and patent-log reading of all changes of course and of all bearings, especially the two and four point bearings, with distance of object when abeam, being noted in a book kept in the pilot house for this especial purpose. The ship's reckoning is thus continuously cared for as a matter of routine and without the presence or particular order of the captain or navigating officer. The value of thus keeping the reckoning always fresh and exact will be especially appreciated in cases of sudden fog or when making points at night.

Where the coastwise trip must be made against a strong head wind, it is desirable, with trustworthy charts, to skirt the shore as closely as possible in order to avoid the heavier seas and adverse current that prevail farther out. In some cases, with small ships, a passage can be made only in this way. The important saving of coal and of time, which is even more precious, thus effected by skillful coast piloting makes this subject one of prime importance to the navigator.

Change in the variation of the compass.[1]—The gradual change in the variation must not be forgotten in laying down on the chart courses and bearings. The magnetic compasses placed on the charts for the purpose of facilitating the plotting become in time slightly in error, and in some cases, such as with small scales or when the lines are long, the displacement of position from neglect of this change may be of importance. The date of the variation and the annual change, as given on the compass rose, facilitate corrections when the change has been considerable. The compasses are reengraved once in ten years; more frequent alterations on one spot in a copperplate would not be practicable.

The change in the variation is in some parts of the world so rapid as to need careful consideration, requiring a frequent change of the course. For instance, in approaching Halifax from Newfoundland the variation changes 10° in less than 500 miles.

Local magnetic disturbance of the compass on board ship.—The term "local magnetic disturbance" has reference only to the effects on the compass of magnetic masses external to the ship. Observation shows that disturbance of the compass in a ship afloat is experienced in only a few places on the globe.

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[1] See H. O. Chart No. 2406, Variation of the compass.

Magnetic laws do not permit of the supposition that the visible land causes such disturbance, because the effect of a magnetic force diminishes so rapidly with distance that it would require a local center of magnetic force of an amount absolutely unknown to affect a compass half a mile distant.

Such deflections of the compass are due to magnetic minerals in the bed of the sea under the ship, and when the water is shallow and the force strong, the compass may be temporarily deflected when passing over such a spot; but the area of disturbance will be small unless there are many centers near together.

Use of oil for modifying the effect of breaking waves.—Many experiences of late years have shown that the utility of oil for this purpose is undoubted, and the application simple.

The following may serve for the guidance of seamen, whose attention is called to the fact that a very small quantity of oil, skillfully applied, may prevent much damage both to ships, especially of the smaller classes, and to boats by modifying the action of breaking seas.

The principal facts as to the use of oil are as follows:

1. On free waves, i. e., waves in deep water, the effect is greatest.

2. In a surf, or waves breaking on a bar, where a mass of liquid is in actual motion in shallow water, the effect of the oil is uncertain, as nothing can prevent the larger waves from breaking under such circumstances; but even here it is of some service.

3. The heaviest and thickest oils are most effectual. Refined kerosene is of little use; crude petroleum is serviceable when no other oil is obtainable, or it may be mixed with other oils; all animal and vegetable oils, such as waste oil from the engines, have great effect.

4. In cold water, the oil, being thickened by the low temperature and not being able to spread freely, will have its effect much reduced, a rapid-spreading oil should be used.

5. A small quantity of oil suffices, if applied in such a manner as to spread to windward.

6. It is useful in a ship or boat either when running, or lying-to, or in wearing.

7. When lowering and hoisting boats in a heavy sea the use of oil has been found greatly to facilitate the operation.

8. For a ship at sea the best method of application appears to be to hang over the side, in such a manner as to be in the water, small canvas bags, capable of holding from 1 to 2 gallons of oil, the bags being pricked with a sail needle to permit leakage. The waste pipes forward are also very useful for this purpose.

9. Crossing a bar with a flood tide, to pour oil overboard and allow it to float in ahead of the boat, which would follow with a bag towing astern, would appear to be the best plan.

On a bar, with the ebb tide running, it would seem to be useless to try oil for the purpose of entering.

10. For boarding a wreck, it is recommended to pour oil overboard to windward of her before going alongside, bearing in mind that her natural tendency is always to forge ahead. If she is aground the effect of oil will depend upon attending circumstances.

11. For a boat riding in bad weather to a sea anchor, it is recommended to fasten the bag to an endless line rove through a block on the sea anchor, by which means the oil can be diffused well ahead of the boat, and the bag readily hauled on board for refilling, if necessary.

CHAPTER I.

GENERAL REMARKS—WINDS—CURRENTS—VIGIAS—COMMUNICATIONS—CORAL ISLAND AND REEFS.

Plan.—The sailing directions of the Pacific Islands are comprised in two volumes, as follows:

H. O. 165, Pacific Islands Pilot, Volume I, covers the Loyalty Islands, New Caledonia, New Hebrides, Santa Cruz, and Solomon Islands, Neu Mecklenburg, and Neu Pommern, Admiralty, Palao, Caroline, and Marshall Islands, the island of Guam, and the Marianas.

H. O. No. 166, Pacific Islands Pilot, Volume II, treats the Cook, Tubuai, and Society Islands, Tuamotu Archipelago, Marquesas, Tonga, Samoa, Fiji, Union, Ellice, Phoenix, Gilbert, and scattered islands lying to the northward of this region known as the Line Islands.

The Cook Islands are included in the Dominion of New Zealand; they lie about 180 miles from Tahiti and are 10 in number. Most of the islands are high, and Rarotonga, the principal island, is the highest.

The Tubuai or Austral Islands, lying about 350 miles southward from Tahiti, form a group of five islands of but little importance and are under French protection.

The Society Islands, which lie but a short distance westward of the Tuamotu Group, present a very different appearance. They are high, mountainous islands, covered with luxuriant vegetation to the summits and well cultivated in the plains and valleys, with numerous streams and cascades running down their sides into the sea.

This group is also in the possession of the French, who have their chief establishment at Papieté in Tahiti Island, a good harbor where supplies of all descriptions can be obtained.

The Tuamotu or Low Archipelago, lying between the parallels of 14° and 25° S., and between the meridians of 125° and 149° W., consists of a mass of low coral islands to which there are only three exceptions, viz: Henderson, Pitcairn, and the Gambier or Manga Reva Islands Navigation among these islands is dangerous on account of the uncertain set of the currents and the still imperfectly charted reefs and islands. However, there is but little inducement for vessels to visit these groups, as the only trade with the natives consists in the purchase of coconuts, which grow on the islands, and a little pearl shell; the natives subsisting mainly on the fish they catch in the lagoons. The islands, excepting Ducie, Henderson, Pitcairn, and Oeno, are French.

The Marquesas Islands, to the northward of the Tuamotu Archipelago, are a French possession. They are high, well wooded islands, with several good anchorages and harbors, the best of which is Tai-o-Hae or Anna Maria Bay in Nukuhiva or Marchand Island, where the French establishment is situated.

Supplies.—These islands are but little cultivated, although the soil is good and well adapted to the growth of cotton, etc. Supplies sufficient for the wants of vessels calling may be obtained at the principal ports, and the natives are willing to trade.

The Tonga or Friendly Islands.—The Tonga Group consists of at least 100 islands and islets, the islands Tongatabu, Eua, and Vavau alone being of any extent, the former being low, and the two latter of moderate height.

The islands lie generally in a long north and south chain, and form the subgroups of Tonga, Nomuka, Haapai, and Vavau, but the outlying islands of Niuatobutabu or Keppel Island; Tafahi or Boscawen and Niuafou are included in the Kingdom of Tonga, which is under the protection of Great Britain.

The residence of the native King and seat of government is at Nukualofa, in Tongatabu.

There are several good harbors in the group.

They were discovered in 1643.

All the natives have embraced Christianity, the greater part as Wesleyans, and the remainder as Roman Catholics.

The natives of Tonga, or Friendly Islands, belong to the fair Polynesian race, and surpass all other Pacific islanders in mental development, in the structure of their dwellings, and in the preparation of their implements, weapons, dress, etc., betraying considerable skill and dexterity. The Tongan dialect is harsher than the Samoan, and is supposed to have been influenced by intermarriage with Fijians.

Trade.—The products principally exported consist of copra and fruit.

Population.—At the census of 1910 the population numbered 21,695; the foreign residents numbered 240.

Ports.—The principal ports are Nukualofa in Tongatabu, Neiafu, and Lifuka.

Supplies—Coal.—Considerable quantities of fish abound in Nukualofa Harbor.

Beef may be obtained once a week; there is a cattle station in the interior of the island.

Mutton of fair quality is obtainable daily, also bread, the sheep being sent across from Eua Island, on which was, in 1898, a sheep run. Water is extremely scarce.

Fowls may be obtained in small quantities, and vegetables in fair quantity.

Coal can be obtained at Nukualofa; about 200 tons are kept in stock.

At Vavau the country affords plenty of vegetables and fruit, but water is both scarce and indifferent. No coal is to be obtained at Neiafu.

Communications.—The Union Steamship Co. of New Zealand maintains a service of vessels, calling every fortnight at the ports of entry and affording a monthly mail service with Australia and New Zealand.

The Samoa or Navigator Islands consist of three principal islands Savaii, Upolu, and Tutuila, and some smaller ones. They were first seen in 1768 and named Isles des Navigateurs, from the skill with which the natives managed their canoes.

The soil is productive; while there are numerous anchorages, there is only one good harbor at Pago Pago in Tutuila. Apia on the north side of Upolu Island is the capital of German Samoa.

Protectorate.—Tutuila and the other islands of the group eastward of it are under the protectorate of the United States of America. The other islands westward of Tutuila are under the protectorate of Germany. The United States flag was hoisted at Pago Pago on April 17, 1900.

The natives of Samoa, or Navigator Islands, are said to be the fairest of all the Polynesian races, and although not so much advanced in the arts and manufactures as some of their neighbors, surpass them all in many characteristics of true civilization. Their habits of cleanliness and decency equal those of the most fastidious of civilized nations. Their public meetings and discussions are carried on with a dignity and forbearance which Europeans do not excel. Besides schools and churches, there exist several institutions for the training of teachers.

Ports.—The principal ports are Apia and Saluafata in Upolu and Pago Pago in Tutuila. The shipping entered and cleared at Apia in 1906 amounted to 78,902 tons.

Supplies.—Wood and water can be had at Pago Pago, Fonga, Tongo, and Fangaalu. Any quantity of water may be obtained at Pago Pago from the reservoir, which communicates with the wharf.

Fruits, such as bananas, oranges, pineapples, coconuts, and plantains are plentiful and can be procured from the natives by barter.

Yams, taro, and breadfruit can be procured in small quantities. The natives have a few fowls and pigs for their own use, but not for sale. There are a few cattle owned by the missionaries, from whom a bullock can be procured occasionally, but this can not be depended on as a source of supply.

At Saluafata Harbor fish, fowls, and eggs can be obtained in small quantities; oranges and coconuts are abundant. Cattle may be procured from a plantation, about 5 miles distant from the coast, and if it be expedient to keep them alive, good pasturage will be found upon the shores of the bay.

Water may be obtained from a stream situated on the southwestern part of the harbor.

At Apia beef, pork, poultry, and the usual tropical fruit can generally be obtained, but are not plentiful.

Water is good: it is stored in tanks and obtained from the river.

Coal.—About 1,000 tons of coal is kept in stock at Apia, and is delivered alongside in lighters, but coaling is impeded at times by the heavy sea.

German ports—Regulations.—The German Government has given notice that under certain circumstances, such as maneuvers, ordinary exercises, or for other causes, it may be necessary to prohibit free entrance into German harbors and river mouths by night.

To indicate that entrance to a harbor is closed, or that obstructions exist therein, three red balls by day and three red lights by night, placed vertically one above the other, will be shown in a conspicuous position near the approach to the harbor.

Vessels must then approach the harbor with the greatest caution. At night it is advisable, when possible, to anchor until daybreak outside the prohibited area.

The same course should be pursued if searchlights are at work, or signals given, the meaning of which is not recognizable from the Sailing Directions or Light Lists.

All merchant vessels desirious then to enter or leave these privileged harbors, must not enter or leave without a pilot, and must submit to examination if required.

The establishment of an examination service will not be notified publicly, but, so far as possible, the requisite reports and directions will be given to approaching vessels by patrol ships, which will also carry the above-mentioned signals, viz., three red balls by day and three red lights by night, and also, under certain circumstances, the pilot flag.

The examination commission (and pilots) are on board the patrol ships; it is in the real interest of masters of vessels to comply with all directions received from them.

Under all circumstances vessels are prohibited from passing the line of patrol ships without communicating with them.

On a gun being fired or signal made from a patrol ship, all merchant vessels must stop immediately.

Not more than three foreign naval vessels can visit a German port without permission.

Fiji Islands, a British colony, comprises, besides numerous islets and reefs, 155 islands containing a total area of 7,500 square miles. About 100 of these islands are inhabited. The group lies in the track between the Australian Colonies, Panama, and British Columbia. Between it and the Australian Colonies is situated the French possession of New Caledonia. On the same side, but to the northward are the group named the New Hebrides; and on the eastern side of the Fiji group, to the north and east, stretch the Navigator and Friendly Islands.

The largest and highest island, Viti Levu, has several peaks rising to a height of 4,000 and one about 5,000 feet above the sea.

Situated thus, nearly equidistant from India and America, and contiguous to the eastern shores of Australia and New Zealand, Fiji is well adapted for the purpose of commerce.

The capital is Suva, on the south coast of Viti Levu.

The Fiji Islands were formally proclaimed a British colony September 1, 1875.

Geology.—These islands consist partly of volcanic elevation surrounded by fringing coral reefs, between which and the land there is often fine anchorage; and partly of coral atolls, with or without openings into the central lagoons.

The tops of many of the mountains have distinct craters, but their activity has long ceased.

The various decomposing volcanic rocks mingled with decayed vegetable matter, and well watered, forms a fertile soil. Most of the high peaks on the large islands are basaltic. Hot springs occur on Vanua Levu, on Ngau, at Wainunu, and Savu Savu.

The government of the Fiji Islands, prior to the cession of the group to Great Britain as a British colony, was carried on under the celebrated and most powerful of the Fijian chiefs, Thakombau, but civil strife was never quite absent among his subjects, except during the latter years of his recognized supremacy by the other chiefs, first among whom may be mentioned the Roko Tui of Lau, Henry Maafu, the once powerful Tongan chief, who for many years disputed the supremacy with Thakombau.

The present government consists of a governor, representing the King, with the usual officials attached to a Crown colony. The seat of the government, formerly at Levuka, in Ovalau Island, is (since 1882) at Suva, in Viti Levu Island.

The population of the Fiji Islands in 1911 numbered 139,541, of which number 3,707 were Caucasian.

Products consist chiefly of copra, sugar, cotton, maize, peanuts, fruit, molasses, bêche-de-mer, fiber, and pearl shells. Vessels engaged in whaling in the South Pacific resorted here many years ago, for the purpose of refitting and replenishing; but, with the decline in whaling, such visits have become matter of the past.

In 1904, 52,138 tons of sugar was exported and 7,506 tons of copra.

The natives of Fiji are a dark-colored, frizzly-haired, bearded race, reproducing in the east the tall and muscular bodies of the finest of the western Papuans, but much superior to them both in regularity of feature and in degree of civilization. They exhibit considerable amount of intermixture with the brown Polynesians of Tongo and Samoa, who long since established colonies in Fiji, and have to some extent modified the language and customs of the aborigines. Yet they remain undoubted Melanesions, and differ from their Maori neighbors not only in their scanty dress, which hardly differs from the New Hebrideans, but in using the bow and arrow and in making pottery, both arts being foreign to the true Polynesians.

The Fijians are cleanly in their habits, and very particular about their personal appearance. In no place has missionary effort been more successful, or its fruits more apparent, than in Fiji. Most of the inhabitants are Christians.

Ports.—The principal ports are Suva, Levuka, Savu Savu, Nukulau Ba River, Lambasa, and Ngawa Rivers.

Supplies such as are necessary for the repair or refit of small ships can be obtained in some of the ports, the details of which will be found in the particular description of each port.

Communications.—The Union Steamship Co. of New Zealand dispatch a steamer monthly from Melbourne, and from Auckland, New Zealand, for Suva and Levuka in Fiji, and have an interinsular service between the principal islands of the Fiji Group.

The Oceanic Steamship Co. maintains a regular line of mail steamers between San Francisco and Sydney, calling at Honolulu and Pago Pago.

The Canadian-Australian Co.'s monthly steamers from Sydney to Vancouver call at Suva when northward and southward bound.

Between Auckland, Sydney, and Fiji there is steam communication every 10 days.

Communication between the islands is maintained by three steamers and a fleet of 162 sailing craft of which 91 are owned by natives (1906).

The Phœnix Group (lat. 4° S., long. 173° W.), a British protectorate of eight scattered islands, situated about 250 miles north of the

Union Group, although only consisting of low coral islands, has proved very valuable from the large amount of guano exported from them; this supply, however, is now practically worked out.

Supplies.—There is little or no water to be procured, nor supplies of any description.

The Ellice Group (lat. 5° S. to 11° S., long. 176° E. to 180° E.).—This group of low coral islands extends about 360 miles in a northwest and southeast direction, and consists of nine atolls or clusters of islands, all of which are inhabited.

Protectorate.—British protectorate was proclaimed over the Ellice Group of islands in September, 1892.

The whole of the islands are under the government of independent native rulers.

Natives.—The natives are described as being quiet and peaceable and resemble in appearance those of Samoa and Tonga Islands.

Population.—In 1911, the population of this group numbered 3,089.

Ports.—The principal anchorages are inside the lagoons at Funafuti and Nukufetau.

Supplies of fish, pigs, poultry, coconuts, and bananas can be obtained at Nurakita, Funafuti, and Nukulailai, but water from wells is neither good or plentiful.

Communication is by steamer from Sydney twice yearly; also by small sailing vessels.

Gilbert Group.—The Gilbert or Kingsmill Archipelago lies between the parallels 2′ 45″ S. and 3° 30′ N. latitude, and the meridians of 172° 30′ and 177° 15′ E. longitude; within this area there are 16 groups of islands. The islands are of the same character as the Ellice Group.

The Gilbert Islands are more barren than the Ellice Group; beyond the coconut tree, the pandanus, and a few shrubs, nothing appears to grow spontaneously.

Protectorate.—British protectorate was proclaimed over Gilbert Group May 27, 1892. They are governed by independent native rulers.

Natives.—The natives are an active and intelligent race and have teachers of the London Missionary Society settled among them.

Communication with the Gilbert Group is not very regular. Sailing vessels make trips to Sydney and San Francisco.

A steamer makes quarterly trips between Sydney and Gilbert Islands.

Climate.—Fine weather prevails from May to September, with occasional showers. During June the weather is hot and dry. From October to April much rain falls.

Supplies.—There is no fresh water, that used by the natives being brackish. No supplies can be obtained at these islands except coconuts.

At Taritari, however, 80 tons of water in cistern are always available.

Population.—In 1911 the population numbered 25,242.

The Line Islands are scattered islands near the Equator in the vicinity of the one hundred and sixtieth meridian west; they are all low coral islands covered with a scanty vegetation and a few coconut trees. From some of these islands guano in large quantities has been exported, but the supply is now nearly exhausted; otherwise they are of but little value, only producing a small quantity of coconuts, etc.

Wind and weather—Barometer.—The general wind system of the Pacific Ocean or of any large area can only be explained by the aid of a comprehensive knowledge of the barometric pressure prevailing, not only over the area in question, but generally over adjacent areas. Modern scientific inquiry, aided by telegraphic communication, has greatly and rapidly extended this sphere of knowledge.

Though certain meteorological facts are now thoroughly established and comparatively well known, it may be well to state shortly the laws governing the relation of wind to barometric or atmospheric pressure. Of these the primary fact is that where atmospheric pressure, from whatever cause, falls below its average, i. e., where there is a deficiency of air, an impulse is given for an inflow of air from any adjacent locality where there exists an area of high pressure, or, in other words, where there is a surplus of air. The strength of the air current or wind caused by these conditions will naturally depend on whether the difference of pressure between centers of low and high pressure areas, as also their distances apart, are great or of but slight proportions; and the movement of the air current will not as a rule be directly toward the low-pressure center, but with an inmoving rotary motion round it.

In north latitude the spiral inflowing movement of the air round areas of low pressure is always in the opposite direction to the motion of the hands of a watch placed face upward, and in south latitude it is the exact reverse; in each case the motion is called cyclonic. Around areas of high pressure the air also circulates, but with an outflowing tendency and always in the opposite direction in each hemisphere to the cyclonic motion; hence this motion is known as anticyclonic.

North Pacific winds—NORTHEAST TRADES.—Across nearly the whole of the North Pacific, from an average of 5° to 25° N. latitude, the northeast trade winds prevail, their force not equal to that of the northeast trades of the Atlantic, though sometimes very strong in the neighborhood of the Hawaiian Islands, and their direction varying between north and east and sometimes even southward of east. The whole area of these trade winds has a lateral oscillatory movement, approaching nearest to the equator during the northern winter months and receding farthest from it in the northern summer; so that in January the southern mid-ocean limit is within 5° of the equator, while in July it is no nearer than about 9°. On the eastern side of the ocean the width of the trade-wind area is at its greatest and on the western side it has least force, and gradually becomes merged in the monsoon system of the China seas.

Northeast trades, prepared by the United States Hydrographic Office.

Month.	Approximate northern limit.								Approximate southern limit.							
	110° W.	120° W.	130° W.	140° W.	150° W.	160° W.	170° W.	180°	110° W.	120° W.	130° W.	140° W.	150° W.	160° W.	170° W.	180°
	N. °	N. °	N. °	N. °	N. °	N. °	N. °	N. °	N. °	N. °	N. °	N. °	N. °	N. °	N. °	N. °
January	13	21	28	27	23	23	24	24	8	8	8	6	5	4	3	3
February	....	27	28	29	28	24	22	22	5	6	6	6	5	6	7	8
March	....	24	25	26	26	24	24	23	6	6	5	4	4	4	4	4
April	....	27	29	30	28	28	29	28	6	6	6	6	6	6	5	6
May	....	28	27	30	28	27	26	27	10	9	8	8	8	7	5	5
June	....	30	31	31	31	31	30	....	11	12	11	10	9	9	7	7
July	....	....	33	34	33	33	33	34	14	14	13	11	9	7	6	6
August	....	....	34	34	33	32	32	32	....	15	14	10	9	9	7	7
September	....	....	30	31	29	30	30	30	14	15	14	12	11	11	11	11
October	....	22	28	30	29	28	28	28	....	13	13	11	10	11	9	5
November	....	24	28	29	28	27	26	26	11	11	11	10	9	8	7	6
December	....	24	27	28	28	26	25	25	8	9	9	9	8	7	6	5

Doldrums.—Between the northeast and southeast trade winds, the latter to be presently described, there is found the usual belt of calms, variable winds, and occasional squalls, known to seamen as the doldrums, but in the Pacific this region is by no means so wide as in the Atlantic.

Between the Hawaiian Islands and California there is an area of constant high barometric pressure; consequently there is an anticyclonic air current around this district, with small variations caused by seasonal modifications of the system.

Westerlies.—From about latitude 30° N. to the northward, the whole distance across the Pacific from west to east until nearing the American coast, when the limit becomes as high as latitude 40° N., the mean direction of the wind is about due west, inclining to the northward of west during summer and to the southward of west during the winter months. Within this area, as in the corresponding belt of the Atlantic, however, cyclonic gales and storms pass from west to east, causing great temporary interruptions to the general system. The actual wind experienced by a ship under these circumstances will depend upon whether the center of depression passes northward or southward of her; if the former, she will have winds from some westerly quarter; if the latter, from an easterly quarter. As the more ordinary track of these cyclonic depressions appears to be along the line or northward of the Aleutian Islands, it follows that vessels navigating the waters to the southward of them will generally be in that half of the depression where westerly winds prevail.

VARIABLES.—Between the westerly winds and the trade winds there is an intermediate space of about 10° of latitude where the wind has no settled direction. For the most part, this region lies between the parallels of 20° and 30° N. latitude, but its position varies with the seasons; in the summer, the trade wind extending to the northward and the southern limit of the west winds receding before it, and vice versa in the winter. Within this space, as in the doldrums, winds from opposite directions, with sharp squalls and calms alternate, rendering navigation very difficult to sailing vessels, and clearly indicating to all such the wisdom of keeping northward of this region if bound eastward, and southward of it if bound westward.

It should be noticed, however, that this unsettled region does not extend across the Pacific from shore to shore, northerly winds prevailing on the American side for 10° or 12° of longitude from the coast, and on the western side, the prevalence of the monsoons is clearly marked as far northward as 30° N. latitude, where they merge in the westerly wind region before described.

Pilot charts.—These charts are published monthly by the Hydrographic Office. The following is a monthly summary of weather forecasts for the North Pacific given on these charts:

From January to April the general movement of the wind will be anticyclonic around the high-pressure system before mentioned, lying between California and the Hawaiian Islands. About the Aleutian Islands is an area of low pressure, its axis just southward of and parallel with them. Between these areas of high and low pressure there will be a general movement of the air from Asia toward America. Between latitudes 35° and 50° N. frequent squalls and gales, with fog, rain, and snow, may be expected. Over Asia at this season there exists an area of high pressure, and the general direction of wind along that coast will be from the northward and eastward.

In May, marked changes of weather may be expected. The high-pressure system between the Hawaiian Islands and California spreads out more, extending chiefly to the northward, while the gradients of the low-pressure system over the Aleutian Islands becoming less steep, the cyclonic circulation around it becomes weaker and the winds lighter.

In the zone between latitudes 35° and 50° N. a constant succession of moderate westerly gales may be expected, accompanied by rain, and northward of latitude 45° N. by hail or snow. These gales, however, are less frequent than in the preceding month, but fog is very common. The high-pressure area over Asia will now have disappeared and the winds on that coast will be variable, with a balance on the northeast coast of northerly winds.

June to August.—The high-pressure area between California and the Hawaiian Islands will be larger than in the winter months, while the low-pressure system over the Aleutian Islands will fill up and in July and August will appear merely as an extension of the low-pressure system at this time prevailing over Asia. In the zone between latitudes 35° and 50° N. gales with rain may be expected, but with less frequency. In the vicinity and southward of the Aleutian Islands the winds will be generally from the southward or westward and from moderate to fresh in strength.

Northward of latitude 40° N., for the whole width of the ocean, fog will be frequently met with.

In September the high-pressure area between the Hawaiian Islands and California moves farther eastward and is of smaller extent; the low pressure over the Aleutian Islands becomes more marked; while a high-pressure system is forming over northern Asia and the low pressure over southeastern Asia is moving southeastward off the coast.

In the zone between 35° and 50° N. latitude gales with rain may be expected with increasing frequency, and northward of latitude 45° N. occasional fog may be expected.

October to December.—The high-pressure system between the Hawaiian Islands and California moves more to the southward and southeastward, and in December its western side is elongated so as to extend nearly across the ocean. The Aleutian low-pressure system becomes well defined with steeper gradients.

In the zone between latitudes 35° N. and 50° N., gales with rain become more frequent. The high-pressure system over Asia becomes well established, and northerly and easterly winds will prevail on that coast.

In October occasional fog may be experienced northward of latitude 45° N.

Barometer.—In the Northern Hemisphere a comparatively low-pressure zone lies just northward of the equator, and does not alter much either in position or pressure with the seasons, the average barometric reading in January being about 29.90 inches, and in July 29.95 inches. In the low-pressure belt of the Aleutian Islands the average reading in January is about 29.55, but in July, when this low-pressure area has nearly filled up, it is about 29.80 inches. In the high-pressure area between these two, of which the highest part is that so frequently alluded to as lying between the Hawaiian

Islands and America, the average reading in January in about latitude 30° N., longitude 140° W., is 30.15 inches, and in July in latitude 35° N., longitude 150° W., 30.30 inches.

South Pacific winds.—In the South Pacific the conditions may generally be assumed, with some modifications, to be the counterpart of those in the North Pacific.

Southeast trade.—The southeast trade is by no means so constant as the northeast trade; generally speaking, it may be said to include an area of about 28° of latitude in width, this area oscillating northward and southward according to the season, as in the case of the northeast trade, but with its northern limit always northward of the equator, reaching, in fact, as far as 8° N. latitude in July and August, but only to about 3° N. latitude in January.

It does not, however, blow across the whole width of the ocean with the regularity which might be expected, except, perhaps, during the months of July, August, and September. At other times there would appear to be great irregularity in the large central region occupied by the Tuamotu or Low Archipelago, the Society Islands, and their vicinity. Beyond this region, but within an area of restricted width, they appear generally to blow home to the southeastern Australian mainland shore.

Southeast trades, prepared by the United States Hydrographic Office.

Month.	Approximate northern limit.								Approximate southern limit.								
	110° W.	120° W.	130° W.	140° W.	150° W.	160° W.	170° W.	180°	80° W.	90° W.	100° W.	110° W.	120° W.	130° W.	150° W.	165° W.	180°
	N. °	N. °	N. °	N. °	N. °	N. °	N. °	N. °	S. °	S. °	S. °	S. °	S. °	S. °	S. °	S. °	S. °
January	4	5	4	4	3	2	1	1	28	29	26	20	29	24	24	28	....
February	3	4	4	5	....	....	....	....	30	28	23	15	25	30	26	25	33
March	3	3	3	3	2	2	0	....	27	27	24	15	22	23	24	22	....
April	3	3	3	3	2	2	1	....	27	26	25	18	26	25	18	28	33
May	4	5	4	4	4	3	2	....	25	24	20	18	20	23	16	27	....
June	5	8	7	6	5	4	3	3	19	24	23	24	22	25	19	25	....
July	7	7	7	7	7	5	4	3	28	27	21	24	26	21	17	23	27
August	8	8	8	8	7	6	5	4	28	24	23	18	18	25	18	25	28
September	7	9	9	9	7	7	7	6	21	23	23	22	19	23	18	25	....
October	6	5	7	8	8	7	7	....	26	27	24	22	23	24	20	25	25
November	6	6	7	6	5	4	3	3	30	28	24	21	19	22	21	24	....
December	5	6	6	6	5	4	3	2	29	29	29	23	21	25	24	26	33

Variables.—Southward of the trade winds is a belt, corresponding to that in the Northern Hemisphere, where very variable winds prevail, chiefly from the northward and northwestward on the western side of the ocean, and from the southwestward and southward near the South American coast. This area gradually merges in higher southern latitudes into the region where westerly winds prevail.

A constant high-pressure barometric system corresponding with that already described in the North Pacific appears to exist in the South Pacific Ocean between the parallels of 15° and 40° S. latitude, and between the meridians of about 80° 140° W. longitude. The winds, as described, will be found to be in conformity with the rule previously mentioned as regards anticyclonic motion in south latitude, but it should be remembered that the whole high-pressure area moves somewhat more to the southward during the southern summer, and to the northward during the southern winter, than its mean position during spring and autumn. In high southern latitudes there is, as in the north, a permanent low-pressure system.

Winds over groups and islands.—Most of the groups and islands described in this work lie within the limits of the trade winds, but some general remarks as to the local winds over and amongst these groups, especially in the large central region of irregularity before referred to, are here annexed.

Easter Island.—At Easter Island (lat. 27° 10′ S., long. 109° 16′ W.) the southeast trade blows steadily from October to April, but in the other months (May to September) when the trade has receded to the northward, westerly winds prevail and there is much rain.

Pitcairn Island.—In the vicinity of Pitcairn Island, at the southeastern end of the Tuamotu Archipelago, there is no regular trade, but in summer the wind is generally between east-southeast and north, and in winter between east-southeast and southwest.

Rapa Island.—At Rapa Island, which is just outside the limits of the southeast trade, the wind is generally from the eastward from October to April, with occasional westerly breezes, especially from December to February. From May to September the prevailing wind is from the westward, with heavy gusts and much rain.

Tuamotu Archipelago.—As before mentioned, the trade wind among the Tuamotu Archipelago is very unsteady both in strength and direction, especially from November to March, when heavy squalls from the westward and northwestward are often experienced. This is the season of the northwest monsoon.

Society Islands.—Among the Society Islands the southeast trade blows steadily from April to December, but during the remainder of the year westerly winds are frequently experienced.

Marquesas Islands.—Even in the vicinity of the Marquesas Group, which should be from its position in the very heart of the trade, the southeast wind is by no means as constant as in the Atlantic Ocean, though the wind is nearly always from the eastward, only occasionally getting westward of north, when it may be expected to turn to a gale. From April to October the wind is generally southeast, whereas from October to April it is usually from east-northeast.

Tonga and Samoa Islands.—The southeast trade blows steadily from May to December with a force of from 1 to 5, but among the

Phoenix and Gilbert Groups, which are near the Equator, the trade blows more from the eastward. During the remainder of the year, from January to April, the trade is frequently interrupted by squalls and breezes from west and northwest accompanied by much rain and violent gales, and hurricanes occur occasionally in the southern groups.

Fiji Group.—The southeast trade prevails throughout the Fiji Group from April to October, subject to deflection in certain neighborhoods, where the trend of the coast and the proximity of high land causes an alteration in the general direction of that wind.

On the south coast of Viti Levu, at night, a light breeze comes off the land; the trade wind here blows from the east-southeastward and prevails between 5 a. m. and 5 p. m. Among the islands off the west and northwest coasts of Viti Levu the southeast wind, interrupted by the lofty hills, is deflected into sometimes a northeast and sometimes a south wind. Violent gusts from off the land are occasionally experienced in this vicinity at night.

In the Lau or Eastern Group the southeast trade winds in the months of September and October at times reach the force of a moderate gale accompanied by haze. At Levuka, in Ovalau Island, near the center of the group, the regular southeast trade wind sets in in the middle of April, ending about the middle of December. From December to March, throughout the Fiji Islands, unsettled weather with northerly winds, accompanied by heavy rain and squalls, is common. Breaks of a few days of fine weather, with light and variable airs and calms, sometimes, however, occur during this period, as, also, a brief return of the southeast wind. The trade wind generally ceases to blow with regularity in October, and November is the month of most calms.

From December to March is the hurricane season, and these storms are sometimes attended by a storm wave, which has been known to rise as much as 10 feet above the ordinary sea level, inundating the low islands and districts exposed to its force, spreading devastation in its path. These storms are cyclonic and occur on an average of once a year. They are most severely felt in the extreme western part of the group.

Line Island.—Near the Equator, in the vicinity of Christmas and Fanning Islands, the trade becomes an easterly wind which blows steadily during the greater part of the year. At Fanning Island, from January to March, the wind becomes uncertain as the southeast trade recedes to the southward, and sometimes strong northerly winds are experienced with much rain.

Hurricanes, etc.—Little is known of the origin of cyclonic storms either in the North or South Pacific, but there can be no doubt that they have their birth in equatorial regions, owe it to the same causes as in the Atlantic or Indian Ocean, are preceded and accompanied by the same barometric indications, and follow very similar courses, traveling westward and diverging at first gradually from a west-northwest or west-southwest direction according as their path lies northward or southward of the Equator, to a more northerly or southerly course, and at last curving away northeastward and eastward or southeastward and eastward, until finally exhausted or absorbed in other wind systems.

In the South Pacific the hot months, December to March, inclusive, are those in which cyclonic storms may be expected; in November and April they are occasionally experienced; but in the remaining months of the year they are practically unknown. In the large area between the Tuamotu archipelago and America no cyclonic storm has been recorded; among the islands of that archipelago they are very rare; over the Society, Tubuai, and Cook Islands they are more frequent; and over the island groups westward of those named they are very common, scarcely a year passing without several of them traversing the area in which lie the Samoa, Fiji, and Tonga Island groups, these groups lying in their main track as they curve away from equatorial regions southwestward, southward, and then southeastward as before described. Many storms, however, make their curve to the southward still farther westward than this group area, and a few eastward of it.

It has been stated that of 125 cyclonic storms of which particulars had been obtained, the tracks of 74 passed through the Samoa, Fiji, and Tonga Island group area, 40 passed round westward of that area, and only 11 passed eastward of it. Though much more information on the subject is desirable, this in all probability represents very fairly the general tracks of these storms.

Though some of the cyclonic storms of the South Pacific are undoubtedly of full hurricane force, they, as a rule, do not appear to be so severe as those of the Atlantic and Indian Oceans or of the China Seas.

In the North Pacific the hurricane months are from July to October, and sometimes November. Cyclonic storms are then of somewhat frequent occurrence on the eastern side of the ocean, off the coasts of Mexico and South California, rare in midocean, but common on the western side, where they are of hurricane force, and frequently pass over the Philippine and adjacent islands, or through the Formosa Channel into the China Sea, there taking the name of typhoons; but the center of the average Pacific hurricane proper, from the vicinity of the Caroline or Ladrone Islands, passes with a wide curve round eastward of but bordering on the coasts of the Philippine Islands and Formosa, on either side of or over Japan, from thence expanding and losing much of its force, close past the southern point of Kamchatka, and, nearly on the arc of a great circle, across Bering Sea, northward of the Aleutian Islands, across the Alaskan Peninsula, and strikes the American coast between the parallels of 48° and 58° N. latitude.

In other months, i. e., from November or December to June, the average track of ordinary gales across the North Pacific from west to east is much the same as in the hurricane months, and, as before noticed, the centers of depressions being generally northward of the Aleutian Islands, vessels southward of those islands are nearly certain of winds from a westerly quarter.

Temperature.—The surface temperature of the Pacific in midocean varies but little when within the Tropics, from 76° to 80° being about the usual temperature, but rising 2° or 3° as either side of the ocean is approached. Beyond the Tropics, the isotherms, or lines of equal temperature, are nearly parallel with the Equator, and oscillate southward and northward from 10° to 15° of latitude, according to the season, though the difference of temperature is greater in the North than in the South Pacific; thus, in February the surface temperature in midocean in latitude 45° N. is about 46°, and in August 64°, a difference of 18°; whereas in latitude 45° S., in February, the surface temperature is about 60°, and in August 50°, a difference of only 10°.

The reports from the *Challenger* expedition show that the water rapidly cools from the surface downward. Between the parallels of 40° N. and 40° S. the temperature at a depth of 1,500 fathoms is about the same, viz., 34° or 35°. Below that depth the water is slightly colder in the South than in the North Pacific, doubtless owing to the slow bottom inflow of Antarctic water, while above that line the water is colder in the North Pacific. On the western side again the bottom water is colder than on the eastern side; this is attributable to the motion of the earth tending to divert the northmoving bottom current to the westward.

Depths.—Soundings have not been conducted on a sufficiently large scale in the Pacific Ocean for more than an idea to be formed of its bed as a whole, though lines of soundings with a view to the laying of telegraph cables have been run from San Francisco to the Hawaiian Islands, and from thence across the ocean to the Ogasawara Islands, southward of Japan, and again from the Hawaiian Islands to Fiji; also from Vancouver to Australia. From these and other independent soundings the general depths appear to be between 2,000 and 3,000 fathoms, but with some deep depressions, especially in the western half of the ocean, where, in the neighborhood of the Kuril, Caroline, Tonga, and Kermedec Islands, especially the latter, are some of the deepest known soundings in the world, varying from 4,000 to over 5,000 fathoms.

A direct line of surroundings from Magellan Strait to New Zealand, between latitudes 52° and 45° S., also shows very even depths, but averaging some 300 or 400 fathoms less than in the North Pacific. Between the Hawaiian Islands and Tahiti, and southward of the latter as far as latitude 40° S. the bottom consists mostly of red clay, except around volcanic islands, where volcanic débris and ordinary mud prevails. In nearly all the soundings manganese is found. In other parts of the ocean, when the depths is over 2,000 fathoms, the bottom is generally of red clay, but in some cases of soft gray mud.

Currents.—The current system of the Pacific Ocean bears a close resemblance to that of the Atlantic and is easily understood, the currents following very much the course of the winds, but as regards both strength and direction, except on the lines of the most frequented trade routes, information is as yet somewhat scanty. The original movement of the surface water being apparently the drift caused by the action of the trade winds, it follows that, with one important exception, the great mass of water in the tropical regions is in motion westward; the configuration of the land, however, in the North Pacific gives a much greater degree of certainty as to its future direction and strength after it has curved away from its equatorial direction northward, on the western side of the ocean, than does that of the South Pacific, with its wide opening southward to the Antarctic regions.

Equatorial current and countercurrent.—The westerly equatorial drift in the South Pacific caused by the southeast trades will generally be found to extend from about 20° or 25° S. latitude to and considerably northward of the Equator; its farthest southern limit being toward the American side of the ocean. In the North Pacific that caused by the northeast trades extends toward the Equator from about 25° N. latitude on the eastern side to 20° N. as the Asiatic Islands are approached. Near the equatorial limits of these currents, which correspond closely with the region of the doldrums, the set is almost due west, but between them is the counter equatorial current setting in the opposite direction and sometimes with great strength.

Though the limits of the countercurrent are imperfectly defined, it appears to lie always northward of the Equator, generally between the parallels of 4° N. and 9° N. latitude, more commonly between 5° N. and 8° N., though sometimes its influence has been felt almost down to the Equator, and it never exceeds 5° in width. It varies greatly in strength, running from half a knot to 2 knots an hour, and, so far as is known, varies also with the season, being stronger from May to October than during the other half of the year, when it sometimes appears to cease. The lines of division between the equatorial and counterequatorial currents are sometimes distinctly marked, the streams of the former being generally at their greatest strength when near these lines of division.

The equatorial current is very strong in places, the southern branch being, as a rule, the strongest; it has been recorded as running more than 4 knots. In 1875 the British naval vessel *Challenger*, on her passage from Honolulu to Tahiti, experienced very strong currents, and found the countercurrent farther northward than usual, the equatorial current only extending southward to latitude 11° N. with a general direction of S. 60° W. 18 miles per diem; its rate may, however, be anything between 12 and 40 miles per diem. From 11° N. to 6° N. the countercurrent was running to the eastward at an average rate of 30 miles per diem, but in latitude 7° N. its rate was 50 miles a day, and the temperature of the water was at its highest, from 80° to 82°.

From 5° N. to 5° S. the southern equatorial current was running to the westward at an average rate of 43 miles a day, but in 1° N. its velocity was no less than 70 miles per day. (In September to November, 1878, as much as 104 miles in one day was experienced by the British naval vessel *Opal.*) Its temperature varied from 79° to 77°, being 77° at its axis of greatest rapidity. This extraordinary rate was also experienced by the French corvette *L'Eurydice* in the month of August, 1857, in 3° 50′ N.

In the North Pacific, on approaching the Asiatic side, the equatorial current turns off to the right, and as the Kuro Siwo, or Japanese current, passes the Japanese Islands in a northeasterly direction. It then traverses the ocean toward Alaska and then flows along the western coast of North America to the southeast, finally rejoining the eastern part of the equatorial current and thus completing the circuit. There is a notable subordinate eddy turning from right to left in the Bay of Alaska; and the Oya Siwo, a small, cold southerly current from Kamchatka and from the Sea of Okhotsh toward Japan, but scarcely any perceptible supply of cold water enters the Pacific from the northward by way of Bering Straits.

In the South Pacific, even within the region of the equatorial current, the stream among the island groups in the western half of the ocean is very irregular, and southward of them the water has a general tendency to flow off in some southerly direction. Eastward of the Tuamotu Archipelago, however, the southern part of the equatorial current appears to turn off to the southward, then southeastward toward Magellan Strait, but the greater part turns eastward and northward up the coast of South America until it again rejoins the eastern part of the equatorial current.

Currents in the Fiji Islands.—In Kandavu Channel, with strong east and southeast winds, the current sets at the rate of 1 mile an hour to the westward, but after westerly winds there is a decided eastward set. At the southern extremity of the group, between Ougea Island and Vatoa Island, a strong southeasterly set has been experienced in October, whereas in the same vicinity in August a west-northwest set of nearly 2 knots has been found.

It is stated that several ships have been swept past Vatoa Island by the current and lost on Vuata, Vatoa Reef to the southward.

While surveying among the Lau Group, in the fine-weather season (April to October), the British naval vessel *Alacity* experienced little or no current, excepting those of a tidal nature near the lagoons and reefs. These are not regular nor do they exceed half a knot an hour. During the summer months an easterly set has been experienced.

Currents among the Eastern Island groups.—Near Pitcairn Island the current generally runs to the westward at about 12 miles a day; but among the Tuamotu Archipelago the currents are very irregular. During the settled weather and a steady trade, the set is usually to the westward from 5 to 25 miles a day; but when the wind is westerly, which is frequently the case between October and March, the current is reversed and runs to the eastward from 1 to 2 knots an hour.

The uncertainty on these occasions, as to the direction in which the current may be running, renders great caution necessary when navigating among this mass of islands.

Among the Cook and Society Islands, the westerly set is fairly regular, and runs at from 12 to 20 miles a day; but strong winds from the opposite direction are liable to influence the rate, and at times reverse the direction of the current.

On nearing the equator, the westerly current, as before remarked, will be found to increase in strength and among the Marquesas runs from half to 2½ knots an hour; but even here, when strong westerly winds have been blowing, the surface water has been observed to run eastward in the channels between the islands.

Near Starbuck and Malden Islands, in latitude 5° S., the current attains a rate of from 32 to 56 miles a day to the westward and much care is requisite when approaching these islands to keep well to the eastward, as with a light trade there would be great difficulty in beating back against the current.

Near Christmas Island, in latitude 2° N., the current generally runs strongly to the westward and northwestward as much as 37 mies a day; but the countercurrent has been experienced nearly as far south as the Equator, and caution is therefore necessary in obtaining good astronomical observations to check the position of the ship.

Among the Hawaiian Islands the current is generally running westward at from 1 to 1½ knots an hour, but it varies a good deal, and runs in the opposite direction at times without any apparent cause.

A more detailed account of the currents among the groups of islands is given in the description of the several groups.

Currents in Barrier Reef and Atoll openings.—It may be here remarked that the streams in these passages are generally very strong, and can not be calculated upon to turn with high and low water. Where a barrier reef is near the shore, a heavy swell will throw so much water over the reef as to cause a constant set out of the opening, and at times across the fairway; a knowledge of these facts should be borne in mind when navigating such localities. An instance of this latter is very marked at Papiete, in Tahiti; also at Taapuna Pass, in the same island; again at Murruroa; and at many other places too numerous to mention.

Caution.—Particular and constant attention must be paid to current when navigating among the groups; for, when near the islands it is sometimes deflected and always accelerated. Again, most of the islands are so low that it is often impossible to see them at night, and ships may be driven on the encircling reefs without any warning from the lead, the reefs having, in general, very deep water close to.

Vigias.—A vigia is a reported shoal, the existence of which or its exact locality is doubtful. In no part of the world are there so many dangerous coral reefs and low islets rising abruptly from great depths as in the Pacific Ocean; in addition, a vast number of vigias have from time to time been reported. Many of these have been disproved of late years by laborious research, but many are still on the charts, and until the existence of doubtful shoals has been disproved they must remain a source of anxiety and perplexity to the navigator. A great number of these reports are from whaling ships, and it is a common saying among whaling captains "that they do not care where their ship is so long as there are plenty of whales in sight"; thus doubtful navigation and strong currents account for a large proportion of vigias that encumber or have encumbered the charts of the Pacific Ocean.

It is therefore most earnestly urged upon those who may observe the appearance of a danger to obtain soundings from a boat if possible. The appearance of vigias sometimes caused by reflection from the clouds, by volcanic disturbance, by shoals of fish, and by marine animalculæ often resemble reefs and breakers so closely as to deceive the most experienced.

Whenever the sea becomes smooth confervoid algæ appear on the surface and form masses of discoloration very like the color of a coral reef some 3 fathoms below water. The most experienced officers will be occasionally deceived by these; also, when there is any meetings of currents of different temperatures shoals of fish often appear, and large fish splash and spout water so as to resemble breakers; there is no doubt that these are the principal sources of vigia.

Coal.—The only places, the description of which are comprised within this volume, at which stocks of steaming coal are kept are Tahiti, Suva, and Apia. About 200 tons is generally in stock at Rarotonga, and small quantities may be had at Nukualofa and Malden Islands; at several other islands a few tons have been occasionally obtained, as mentioned in the body of this work, but no supply can be depended on.

Uniform system of buoyage.—In 1893 the French Government adopted the following system for their possessions in the Pacific, viz: The Tuamotu Archipelago, Society Islands, and Tubuai or Austral Islands, including Rapa or Oparo Island:

"Entering from seaward, starboard-hand beacons are painted red and surmounted by conical topmarks. Port-hand beacons are painted black and surmounted by cylindrical topmarks."

Repairs.—In the Tuamotu Archipelago it is probable that many of the lagoons affords places suitable for heaving a ship down in case of necessity. One such in the island of Takarava is suggested by French officers as suitable for this purpose, but in any such case the repairs to be effected would depend entirely upon the resources of the damaged vessel herself both as regards work and materials.

Natives.—The great Pacific basin has been divided for ethnolopical discussion into six portions, namely: Australia and Tasmania; Malaysia, including the islands of the Malay Archipelago from Sumatra to the Moluccas and Philippines; Melanesia, including the chief islands inhabited by the black and wooly-haired race from New Guinea to Fiji; Polynesia, including all the larger islands of the central Pacific from the Hawaiian Islands southward; Micronesia, comprising the small islands of the North Pacific; and, lastly, the New Zealand Group.

Missions.—Missionaries or teachers are established on nearly all the inhabited islands described in this volume, and the natives, having very generally adopted some form of Christianity, have become friendly; shipwrecked persons need have no hesitation in landing at any place, as they will almost certainly be kindly treated and cared for. Unhappily the native populations seem to be very generally decreasing.

The natives of the central and eastern Pacific Islands are mostly Wesleyans and Congregationalists, the missions being chiefly maintained by the London Missionary Society. The Boston Board of Foreign Missions (Congregationalists) also take a large part in native instruction in various groups of the Pacific Islands, as do also various Roman Catholic missions.

Communications.—The following steam communication exists between the coast ports of the Pacific and some of the islands described in this volume: The vessels of the Oceanic Steamship Co. call at Honolulu and Pago Pago on their way between San Francisco and Australia. The Canadian & Australasian R. M. Steamship Co. also has steamers running between Victoria, B. C., and Sydney, starting from Victoria and calling at the Hawaiian Islands, Samoa, and Fiji on the way. There is a line of schooners running from San Francisco to Tahiti and Samao.

Coral islands and reefs—Definitions.—As the various forms of coral structure are best understood under well-defined names, a description of those principally in use is now given:

An atoll may comprise one or any greater number of coral islands of little height above the sea, situated on a strip or ring of coral surrounding a central lagoon. The Tuamotu Group of islands are nearly all of this character.

Many of these atolls have passages through the ring of coral reef of sufficient depth to admit the passage of ships to secure and sheltered anchorage in the inclosed lagoon; but in some, the passages merely admit boats, while in others the ring is without an opening.

Atollon is the name applied to a small atoll on the margin of a larger one.

A barrier reef may front a coast line or encircle an island or group of islands, leaving a deep channel between it and the shore. The Great Barrier Reef of Australia which trends for about 1,000 miles in a northwesterly direction, varying in distance from 12 to 140 miles from the Queensland coast, is an example of the former, and the Barrier Reef surrounding Tahiti, the pricipal island of the Society group, is an example of the latter. These barrier reefs form natural breakwaters with passages through them into good harbors; these passes are generally opposite a valley in the land sheltered by the reef. Tidal streams and currents are generally strong and uncertain in these barrier openings.

A fringing reef is a coral reef extending from the shore, seldom for a long distance, having little water on it, and no ship passage between it and the land. As the seaward face of these reefs is generally the highest part, the tide is more or less impounded on some of them, facilitating navigation by canoes or boats at low water in the narrow passages which generally exist. A coast line with a fringing reef has frequently a barrier reef also with a deep passage between these reefs.

Navigation among coral reefs.—As successful navigation through or among coral reefs is often dependent upon the eye, it is as well to name the conditions under which reefs are most easily to be seen—thus, they are always more plainly to be seen from the masthead than from the deck or bridge, and when the sun is high rather than when it is low; as also with the sun behind the observer rather than facing him. If the sea is glassy calm it is extremely difficult to distinguish reefs.

The best conditions therefore are with the sun high and behind the observer and the sea ruffled by a pleasant breeze. Reefs with about 3 feet water over them then appear of a light brownish color; those with a fathom or more of a clear green, deepening to a darker green as the water increases in depth, and finally to a deep blue when out of soundings.

Under favorable circumstances a bank with a depth of 3 or 4 fathoms over it, can be seen from aloft at a considerable distance, but where, and in proportion as, the depths increase beyond this, the bottom will only be seen when nearly over it.

Routes.—For all practical purposes of navigation between the various groups, or isolated places included in this work, it will be sufficient to draw attention to the fact that they lie within the limits of the trade winds, and of the equatorial current. For sailing vessels this means a fair wind, and current from the eastward to the westward, excepting with regard to the currents when within the limits of the counter equatorial current, and a beat to windward against the current and a choppy sea, in the opposite direction. Vessels of auxiliary steam power would be placed under similar conditions, and those of full steam power would take a direct course.

Steamers to and from the coasts of North and South America or among the islands lay their courses as direct as possible. Sailing vessels bound westward to their ports of destination take advantage of the trades and find no difficulty in making fairly direct routes. If, however, their destination lies to the eastward, as for instance, Fiji to Tahiti or Pitcairn, the sailing vessel should stand through the trades into the region of westerlies, running the easting down until the meridian of her port is reached, when she should reenter the trades and proceed to her destination.

In steamers bound from Magellan Strait to Tahiti a course should be taken to cross 30° S. in the longitude of 97° W., thence southward of Pitcairn Island and the Tuamotu Archipelago. If bound in the other direction proceed as direct as possible. A sailing vessel at any of the Pacific Islands and bound for Cape Horn should stand southward through the trades into the westerlies and proceed for the Cape.

From Sydney or Wellington steamers proceed and return as directly as possible. Sailing vessels pass through Cook Strait (or pass southward of South Island) thence run the easting down southward of 40° S. until 156° or 155° W., when they should edge away to the northward to cross 30° S. on the meridian of Tahiti and thence proceed as direct as possible. In returning, if for Sydney, a vessel should run with the trade, pass about 150 miles southeastward of New Caledonia, and then proceed direct. If for Wellington, run with the trade wind until in 170° W. and then direct.

From Tahiti to Honolulu and back the route for full-powered steamers is direct both ways.

Sail and auxiliary steam route.—Cross the Equator in about 147° W. and make the Hawaiian Islands from the eastward so as to insure the breeze. In the return route cross the equator as far eastward as possible. It is even recommended to keep to the northward and make casting before standing through the trades.

From Fiji to Honolulu and back the route for full-powered steamers is direct both ways.

Sail and auxiliary steam route.—Stand through both trades and into the westerly winds northward of the northeast trade; from thence making easting to about 155° W.; and from thence proceed direct. In returning, proceed direct.

CAUTION TO BE OBSERVED WHEN APPROACHING BRITISH PORTS.

PART I. CLOSING OF PORTS.

(1) As circumstances may arise in which it will be necessary, on account of periodical exercises, maneuvers, or otherwise, to forbid all entrance to certain ports of the British Empire, on approaching a port a sharp lookout should be kept for the signals described in the following paragraph, and for the vessels mentioned in paragraph (2), Part II of this notice, and the distinguishing and other signals made by them. In the event of such signals being displayed, the port should be approached with great caution, as it may be apprehended that obstructions may exist.

(2) If entrance to a port is prohibited, three red vertical lights by night, or three red vertical balls by day, will be exhibited in some conspicuous position in or near to its approach, which signals will also be shown by the vessels indicated in paragraph (2), Part II, of this notice.

If these signals are displayed, vessels must either proceed to the position marked "Examination anchorage" on the charts and anchor there, or keep the sea.

PART II. EXAMINATION SERVICE.

(1) Under certain circumstances it may become necessary to take special measures to examine vessels desiring to enter the ports or

localities at home or abroad, referred to in Notices to Mariners No. 1 of 1916 and subsequent years.

(2) In such case, vessels carrying the distinguishing flags or lights mentioned in paragraph (4) will be charged with the duty of examining ships which desire to enter the ports and of allotting positions in which they shall anchor. If Government vessels, or vessels belonging to the local port authority, are found patrolling in the offing, merchant vessels are advised to communicate with such vessels with a view to obtaining information as to the course on which they should approach the examination anchorage. Such communication will not be necessary in cases where the pilot on board has already received this information from the local authorities.

(3) As the institution of the examination service at any port will never be publicly advertised, especial care should be taken in approaching the ports, by day or night, to keep a sharp lookout for any vessel carrying the flags or lights mentioned in paragraph (4), and to be ready to "bring to" at once when hailed by her or warned by the firing of a gun or sound rocket.

In entering by night serious delay and risk will be avoided if four efficient all-round lamps, two red and two white, are kept available for use.

(4) By day the distinguishing flags of the examination steamer will be a special flag (white and red horizontal surrounded by a blue border) and a blue ensign.

Also, three red vertical balls if the port is closed.

By night the steamer will carry: (*a*) Three red vertical lights if the port is closed; (*b*) three white vertical lights if the port is open.

The above lights will be carried in addition to the ordinary navigation lights, and will show an unbroken light around the horizon.

(5) Masters are warned that when approaching a British port where the examination service is in force they must have the distinguishing signal of their vessel ready to hoist immediately when the examination steamer makes the signal.

(6) Masters are warned that, before attempting to enter any of these ports when the examination service is in force, they must in their own interests strictly obey all instructions as to entry given to them by the examination steamer. In the absence of any instruction from the examination steamer they must proceed to the position marked "Examination anchorage" on the charts and anchor there, or keep the sea.

While at anchor in the examination anchorage, masters are warned that they must not lower any boats (except to avoid accident), communicate with the shore, work cables, move the ship, or permit anyone to leave the ship without permission from the examination steamer.

(7) In case of fog, masters of vessels are enjoined to use the utmost care, and the examination anchorage itself should be approached with caution.

(8) Merchant vessels, when approaching ports, are specially cautioned against making use of private signals of any description, either by day or night; the use of them will render a vessel liable to be fired on.

(9) The pilots attached to the ports will be acquainted with the regulations to be followed.

FRENCH TERRITORIAL WATERS—REGULATIONS FOR ADMISSION OF FOREIGN MEN-OF-WAR IN TIMES OF PEACE, WAR, AND MANEUVERS.

IN TIME OF PEACE.

The following regulations have been issued for the admission of foreign men-of-war to French territorial waters in time of peace by French Government decrees of May 21, 1913, and of August 30, 1913, viz:

1. The term "man-of-war" is herein considered to apply not only to all vessels designated as such in the ordinary meaning of the term, but also to auxiliary vessels of every description.

2. For the purposes of the present regulations the French littoral is divided into sections and the French colonies into groups; each group constitutes a section. The Colonies of New Caledonia and Tahiti form Group V, to which the following regulations apply:

3. In time of peace foreign men-of-war are given standing permission to visit French ports and those of French protectorates, and to anchor in territorial waters, on condition that the number of such vessels flying the same flag does not exceed three per section.

In reckoning the number of vessels which can be admitted into a section at one time, vessels already in that section must be taken into account.

Notice of a projected visit should, however, always be transmitted through the usual diplomatic channels so as to arrive, if circumstances permit, at least 30 days before the date of the visit, in the case of Section V.

Foreign men-of-war may not stay more than 15 days in ports and territorial waters. They will be required to put to sea in six hours if requested to do so by the naval authorities or by the senior officer of the garrison ("commandant d'armes"), even if the prescribed term of stay has not expired.

4. The duration of the visit must not be prolonged, nor a greater number of ships than is laid down in article 3 admitted, without the

special permission of the French Government, which must be obtained through the usual diplomatic channels.

5. The regulations in articles 3 and 4 do not apply:

(*a*) To ships of war and vessels on board of which are embarked heads of States, members of reigning dynasties or their suites, or diplomatic representatives accredited to the government of the Republic.

(*b*) To men-of-war compelled to put into port by reason of damage sustained, bad weather, or other unforeseen causes.

(*c*) To vessels engaged in the superintendence of fisheries, in accordance with the convention relating to those fisheries.

6. In ports which are chief naval ports of arrondissements or the headquarters of a senior naval officer the right of assigning anchorage berths to foreign men-of-war, or of directing them to shift berth if necessary, is vested solely in the préfet maritime or senior naval officer (commandant de la marine).

At all other ports it is vested in the captain of the port.

7. Upon entering a port, foreign men-of-war will be boarded by a naval officer, sent by the préfet maritime or senior naval officer, or by a port official sent by the captain of the port, who will offer the commanding officer the courtesy of the port.

The officer will inform the commanding officer of the anchoring berth which has been allotted to his ship and will obtain particulars as to the object and proposed duration of the visit, the name of the commanding officer, and the information it is usual to obtain upon such occasions.

Should the officer sent to welcome the foreign man-of-war arrive on board after she has already anchored or made fast, he will nevertheless make the prescribed communication and inquiry, and he will either confirm the anchoring berth taken up or assign another berth.

At an anchorage or roadstead where there is no captain of the port and no French man-of-war is present, the foreign man-of-war will be boarded under the conditions laid down in this article by the senior officer of the garrison (commandant d'armes) or by an officer detailed by the senior local civil authority.

8. Foreign men-of-war calling at a port or entering territorial waters are required to respect the fiscal laws and the laws and regulations regarding sanitation.

They are also required to adhere to all port regulations to which vessels of the French Navy are subject, and for this purpose the local naval authority will furnish the commanding officer with all necessary information concerning them.

Foreign men-of-war are forbidden within territorial waters to take bearings of the land or soundings or to carry out without permission landing or firing exercises.[1]

No submarine work, executed with or without divers, is to be undertaken without previous notice to the naval authorities.

Men belonging to ships' companies and troops must be unarmed when landed. Officers and petty officers (or noncommissioned officers) may carry the side arms that form part of their uniform.

The number of liberty men to be landed, the time of landing, and return on board will be fixed by arrangement with the local civil authorities and the commandant d'armes.

Boats moving in ports and territorial waters may not be armed.

A sentence of death may not be carried out by any foreign man-of-war in territorial waters.

If a funeral is to take place on shore, and the commanding officer desires an armed party to accompany the procession, he must obtain the permission of the commandant d'armes.

9. The regulations for the admission of belligerent foreign men-of-war are set forth in the decree of October 18, 1912,[2] but remain subject to the formalities of notification or previous authorization specified in articles 3 and 4 of the present regulations, except in cases of force majeure provided for in paragraph (*b*) of article 5.

10. Should a foreign man-of-war fail to comply with the regulations set forth in this decree, the local naval or military authority will first call the attention of her commanding officer to the infringement committed, and formally request him to observe the regulations. Should this course fail, the qualified authority, Préfet maritime, senior naval officer, or commandant d'armes, may request the foreign man-of-war to leave the port or territorial waters immediately.

REGULATIONS FOR APPROACHING FRENCH TERRITORIAL WATERS IN TIME OF WAR.

IN TIME OF WAR.

Decree dated May 26, 1913:

1. In time of war the visits of ships, other than French war vessels, to anchorages and ports on the French littoral or in French protectorates, are governed by the regulations given below.

2. No French merchant vessel or foreign war or merchant vessel may approach within 3 miles of the coast in French territorial waters or of French protectorates without permission without running the risk of being destroyed.

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[1] This paragraph is only intended to prohibit action amounting to the making of surveys, or examination by soundings; operations necessary for safe navigation are not prohibited.

[2] Not published.

3. Between sunrise and sunset every vessel affected by the present decree is to fly her national flag, and number by international code (if she has one), as soon as she approaches the forbidden zone. If desirous of entering the latter, a request is made by hoisting the pilot signal, the ship remaining outside the zone until authorized to enter, by semaphore, the signal station, or examination vessel.

The reply from a semaphore or signal station is made in the international code by the following signs:

S flag	Entry permitted.
D pendant	Entry deferred.
Q flag	Entry forbidden.

If permission to enter is given, a ship is to steam at reduced speed in the forbidden zone, keeping the signal for a pilot flying.

If entry is deferred, a ship is to maneuver so as to clear the entrance to the channels and await the examination vessel, steaming toward the latter at reduced speed when seen.

If entry is forbidden, a ship is to abandon the idea of entering and make for another anchorage.

The examination vessel is distinguished by three balls on the same halyard.

4. Between sunset and sunrise every vessel affected by the present decree is to fly her national flag and have navigation lights lit on approaching the forbidden zone. If desirous of entering the latter, a request is made by burning one or more Bengal lights and blowing blasts on the whistle or siren, the ship remaining outside the zone until permission to enter has been granted by an examination vessel.

The ship., with her navigation lights showing, will await the examination vessel and continue to burn Bengal lights to attract attention, and if not warned, on sighting the examination vessel, may steam toward her at reduced speed.

The examination vessel is distinguished by three red lights superimposed.

A red Coston light, exhibited from a station on shore, signifies that entrance is forbidden; a ship must then give up the idea of entering and make for another anchorage.

5. In foggy weather every vessel affected by the present decree desirous of entering the forbidden zone is to hoist the same signals as in clear weather and blow blasts on the whistle or siren until permission to enter has been given by an examination vessel.

6. Every vessel affected by the present decree must immediately comply with the orders of a war vessel or examination vessel, semaphore, or signal station, given by voice, international signal code, or by warning gun.

Every ship warned by a battery or war vessel, whatever her distance from shore may be, is to immediately stop. When stopped, a ship may renew her request to enter, but must await where she is, orders which will be notified.

If, in spite of warning given by the firing of a blank charge, a ship does not stop at once, a premonitory shot will be fired two minutes later, and if after the expiration of a further two minutes' interval the ship is still under way, effective fire will be opened on her.

In cases of emergency the blank charge may be omitted.

At night the warning gun may also be omitted, and every ship entering the forbidden zone without permission is liable to be destroyed without preliminary warning.

7. Vessels authorized to enter the roadsteads and ports of France and her protectorates are to take up the berths indicated by the local authority and conform strictly to the regulations of every nature issued by that authority.

The length of stay of a ship will depend on military considerations, and when circumstances require it a ship may be ordered to put to sea or to move to a determined point. Such order must be carried out without delay, though respite may be allowed to ships really unable to conform to it immediately.

No vessel is to get under way, either to change berth or to quit the roads, without the permission of the local authority. A request may be made by signal—S flag.

8. In naval roads and ports between sunset and sunrise the movement of boats, other than those of war vessels, is absolutely forbidden.

From sunrise to sunset movement is only allowed to boats which have received a special permit from the naval authorities and the means of making themselves recognizable.

Boats with permits should steer clear of war vessels if ordered to do so, and can not in any case go alongside the latter without their permission. The movement of these boats will, moreover, remain subject to local regulations, notably those relative to the prohibition to enter certain parts of the roadstead and to go alongside at any other places than those specially notified.

In commercial ports similar measures will be taken by the local authority to impose the restrictions judged necessary on the movement of boats, due consideration being given to the interests of commerce.

9. Visits by neutral war vessels are governed by the decree of May 21, 1913, so far as notification or previous authorization is concerned, the regulations for entry being governed by the present decree.

10. The measures provided for by the present decree are to come into force on mobilization or on special notice.

11. Any infraction of the present decree will lead to such repressive measures as circumstances admit of, in addition to the risk of destruction incurred.

12. Regulations contrary to the present decree are canceled.

13. The minister of marine is charged with the execution of the present decree.

REGULATIONS CONCERNING THE TEMPORARY CLOSING OF PORTS FOR EXERCISES, MANEUVERS, ETC.

DURING MANEUVERS.

Access to French ports may be forbidden or submitted to certain regulations on account of naval maneuvers, exercises, or for any other cause.

Under these circumstances—

1. A warning signal will be made from a conspicuous point consisting of three balls, one above the other, by day, and three red lights, one above the other, by night.

2. The same signal will be shown from the watch vessel.

3. Any vessel wishing to go into or out of French waters when one of the above signals is made ought, by day, to hoist the pilot flag and await the arrival of the watch vessel; by night, to burn one or more Bengal lights, supported by the whistle or the siren, and await the arrival of the watch vessel.

4. At the challenge or warning shot from the watch vessel every vessel must immediately stop or heave to.

5. Vessels will in this case be subject to a visit by the watch vessel, which will give them instructions as follows:

(*a*) If a special examination service is established where it will be found.

(*b*) If the entrance to the port is closed and for how long.

(*c*) If any special instructions exist for the navigation of a fixed region.

6. For vessels leaving port the required instructions will be given in the port itself by the maritime authorities.

7. Vessels which disobey the above instructions will do so at their own risk and peril, and will be obliged to make good any damage they may be the cause of.

French defended ports or French ships of war at exercise.—Every vessel seriously inconvenienced by searchlights which are being exercised at defended ports or by French ships of war should make use, either separately or, as far as possible, at the same time, of the following signals:

(*a*) By flashing lamp—four short flashes followed by one long flash.

(*b*) By whistle, siren, or foghorn—four short blasts followed by one long blast.

These signals should not be used without real necessity, and only when the vessel finds herself actually in the rays of a searchlight, then only can it be seen which searchlight is inconveniencing her, and it will then be doused or its direction altered.

The signals should be repeated until the searchlight has been doused or its direction altered.

Vessels failing to use these signals will be held responsible for accidents that may occur.

Pilot vessels—Lights.—Pilot vessels, when engaged on their stations on pilotage duty, shall not show the lights required for other vessels, but shall carry a white light at the masthead, visible all around the horizon, and shall also exhibit a flare-up light or flare-up lights at short intervals, which shall never exceed 15 minutes.

On the near approach of or to other vessels they shall have their side lights lighted, ready for use, and shall flash or show them at short intervals, to indicate the direction in which they are heading; but the green light shall not be shown on the port side, nor the red light on the starboard side.

Such lights shall be placed so that the vertical distance between them shall be not less than 6 feet and not more than 15 feet, and so that the horizontal distance between them, measured in a line with the keel, shall be not less than 5 feet and not more than 10 feet. The lower of these two lights shall be in the direction of the nets, and both of them shall be of such a character as to show all around the horizon, and to be visible at a distance of not less than 3 miles.

A pilot vessel, of such a class as to be obliged to go alongside of a vessel to put a pilot on board, may show the white light instead of carrying it at the masthead, and may, instead of the colored lights above mentioned, have at hand, ready for use, a lantern with a green glass on the one side and a red glass on the other, to be used as prescribed above.

A steam pilot vessel, exclusively employed for the service of pilots licensed or certified by any pilotage authority or the committee of any pilotage district, when engaged on her station on pilotage duty, and not at anchor, shall, in addition to the lights required for all pilot boats, carry at a distance of 8 feet below her white masthead light a red light, visible all around the horizon, and of such a character as to be visible on a dark night with a clear atmosphere from a distance of at least 2 miles, and also the colored side lights required to be carried by vessels when under way.

When engaged on her station on pilotage duty and at anchor she shall carry, in addition to the lights required for all pilot boats, the red lights above mentioned, but not the colored side lights.

Pilot vessels when not engaged on their station on pilotage duty shall carry lights similar to those of other vessels of their tonnage.

Fishery lights.—Fishing vessels and fishing boats, when under way and not required by this article to carry or show the lights hereinafter specified, shall carry or show the lights prescribed for vessels of their tonnage under way.

(*a*) Open boats, by which is to be understood boats not protected from the entry of sea water by means of a continuous deck, when engaged in any fishing at night with outlying tackle extending not more than 150 feet horizontally from the boat into the seaway, shall carry one all-around white light.

Open boats, when fishing at night, with outlying tackle extending more than 150 feet horizontally from the boat into the seaway, shall carry one all-around white light, and, in addition, on approaching or being approached by other vessels, shall show a second white light at least 3 feet below the first light, and at a horizontal distance of at least 5 feet away from it in the direction in which the outlying tackle is attached.

Vessels and boats, except open boats, as defined in subdivision (*a*), when fishing with drift nets, shall, so long as the nets are wholly or partly in the water, carry two white lights where they can best be seen.

CHAPTER II.

SOUTHERN OUTLYING REEFS AND ISLANDS—TUBUAI, COOK, AND PALMERSTON ISLANDS.

General remarks.—Before proceeding to a description of the better known groups of the South Pacific, it will be well to give a short description of the southern outlying reefs and islands, some of which lie so far out of the ordinary track of shipping that their position is in all cases very doubtful, and in some cases even their existence is questionable.

Dougherty Island (lat. 59° 21′ S., long. 120° 20′ W.), one of the most desolate and isolated spots in the ocean, was reported by the master of the whaler *James Stewart* as having been sighted by him May 29, 1841. He passed within 600 yards of it, running 10 knots, and estimated it to be 5 or 6 miles long northeast and southwest, with a high bluff at the northeastern end and low land at its southwestern point. Between the ends there appeared to be a valley covered with ice and snow. He estimated its position to be approximately latitude 59° 20′ S., longitude 120° 20′ W.

On September 4, 1859, the master of the *Louise*, of Bristol, sighted evidently the same island, though he places it farther eastward, viz, latitude 59° 21′ S., longitude 119° 7′ W. He describes it as a round island, of a dark color, and 80 feet high.

The bark *Cingalese* reported in 1886 having, in company with the ship *City of Agra*, been close to this island for three days. It was described as 6 miles long and 300 feet high at the bluff at its northeast end, very rugged at its southwest end, and that there was no sign of snow or vegetation on it. The master also stated that he saw the island again in 1890.

In spite of the fact that this island has been searched for on several occasions without success, there is not sufficient evidence to warrant expunging this island and it is retained on the charts.

Nimrod Islands (lat. 56° 20′ S., long. 158° 30′ W.) are stated to have been seen by the master of the ship *Nimrod* in 1828 in her passage from Port Jackson round Cape Horn. They appear to have been seen at a considerable distance, but numerous birds were also seen, and much marine vegetation was floating about, indicating their actual existence.

An ineffectual search was made for this group in 1831, but was directed to latitude 56° 03′ S., longitude 157° 50′ W., which might account for not finding them. Many birds and marine vegetation were, however, seen, and this was again the case in the following year nearly 2° farther eastward.

The group is charted as "doubtful."

There not being sufficient evidence to warrant expunging these islands, they are retained on the charts.

Bank.—In 1913 the American schooner *Sophie Christenson* reported a patch of discolored water, having the appearance of a bank with a depth of about 5 fathoms over it, in approximately latitude 41° 26′ S., longitude 148° 26′ W., but no soundings were taken.

Maria Theresa Reef, which was reported in 1843 by the master of the *Maria Theresa* to be in latitude 37° 00′ S., longitude 151° 00′ W., is placed by subsequent investigation in latitude 37° 00′ S., longitude 151° 13′ W.

Jupiter Breakers.—The master of the German bark *Jupiter*, on a voyage between Newcastle (New South Wales) and Tahiti, reported having passed breakers during the night of December 3, 1878, in latitude 36° 37′ S., longitude 150° 15′ W. The breakers were observed in two places, each of which had a diameter of about 30 yards, and appeared to be ¼ mile apart. No further intelligence has been obtained regarding this shoal.

Ernest Legouve Reef.—The master of the *Ernest Legouve* reported, in 1902, having passed a reef 100 yards long, and a second one near it, in latitude 35° 14′ S. and longitude 150° 38 W.

The first of these was observed to have very little water on it and was, after passing it, seen to break.

Wachusett Reef.—The master of the ship *Wachusett* reports that on June 4, 1899, about 9 a. m., the sea being smooth and the weather clear, he passed over a reef, which appeared to be of coral formation, in approximately latitude 32° 18′ S., longitude 151° 08′ W. The reef appeared to be about 500 feet wide. The bottom showed of a dark gray color with deep blue on both sides of the reef. The depth was estimated at from 5 to 6 fathoms; unfortunately no soundings were taken.

Orne Bank.—On September 11, 1874, in fine weather, smooth water, and a breeze from south-southeast, the French transport *Orne*, standing to the eastward at the rate of 7 knots, passed over and apparently touched upon a bank on which almost immediately afterwards a depth of 16 fathoms rock was found; with the vessel hove-to for nearly an hour, head to the eastward, the depths increased to 19 and 34 fathoms, rock and sand. About 3 miles eastward of the first sounding there were 52 fathoms, rock, and at a distance of 5 or 6 miles 101° from the 16-fathom spot no bottom was obtained at 98 fathoms. The approximate position of the depth of 16 fathoms, deduced from good observations, is in latitude 27° 42′ S., longitude 157° 44′ W.

In 1887 the French naval vessel *Fabert* searched for Orne Bank, and sounded over a space some 50 miles in extent. She did not find the shoal spot described by the *Orne*, and only succeeded in getting bottom three times, viz, in 34, 35, and 68 fathoms, rock, in latitude 27° 42′ S., longitude 157° 36′ W., or about 8 miles eastward of the depth of 16 fathoms reported by *Orne* in 1874.

Haymet Rocks were reported by the master and owner of the cutter *Will Watch*, when on passage between Auckland and Rarotonga in 1863. The cutter passed between two rocks and struck on the northern of the two, damaging her false keel. The rocks are said to extend over a space of about ¼ mile, to have been distinctly seen, and with apparently 7 or 8 feet water on them. Their position was given as latitude 27° 11′ S., longitude 160° 13′ W., which would place them about 135 miles 284° from the position assigned to Orne Bank.

These rocks were unsuccessfully searched for in the position given by the British naval vessel *Satellite* in 1886, and again by the French Government vessel *Fabert* in 1887. The latter vessel spent three days in the search under favorable circumstances of wind and weather, running over some 253 miles within a radius of from 20 to 25 miles of the position assigned, and with no result.

In December, 1882, however, Lloyd's agent at Rarotonga reported that the Haymet Rocks were supposed to exist about 150 miles 213° of Rarotonga, and therefore right in the track of vessels bound from Auckland to that island, who always give this supposed position a wide berth. If this information is correct, these rocks are about 240 miles 343° of the position as originally given and still shown on the charts; and it is not surprising that both the *Satellite* and the *Fabert* failed in their search in an entirely different locality.

Bank.—A depth of 68 fathoms, rock, was found by the *Fabert* in latitude 24° 7′ S., longitude 158° 33′ W. This vessel was at the time searching for a low island which had been reported to exist in this neighborhood but of which she saw nothing.

Maretiri or Bass Islands (lat. 27° 55′ S., long. 143° 26′ E.) consist of four small islets lying about 46 miles eastward of Rapa Island. The southeast rock, 346 feet above the sea, is the highest of the group. The western rock is 280 feet high and the northeastern rock 195 feet high. Between these are two remarkable columnar rocks 135 feet high. In the northwestern part of the group are four rocks of less height. All these rocky islets are abrupt and without vegetation or any low ground.

The greatest diameter of the group between one of the low northern rocks and the southeast rock is about 2 miles; and within the outer rocks the whole area is full of rocky heads. Rocky surroundings extend for about 1 mile all around the group.

Rapa or Oparo Island (lat. 27° 36′ S., long. 144° 17′ W.).—This island, which was formally taken under French protection in March, 1881, was discovered by Vancouver on December 22, 1791. It is about 380 miles southeastward of Tubuai, forming a prolongation of the chain of islands of that group.

Aspect.—Rapa Island is circular but of a very irregular form, about 15 miles in circumference, with several deep indentations in the coast, the largest of these being Ahurei Bay. The coast is bold, and has no off-lying dangers beyond ½ mile from the shore, but many of the smaller bays, though full of shoals and not to be entered by a stranger without a native pilot, afford anchorage to schooners and have beach at their heads. Everywhere else the coast is quite inaccessible, with deep caverns worn in the cliffs by the action of the sea.

Mountains.—Both the form and appearance of the island are remarkable, it being evidently an ancient volcano, of which the head of Ahurei Bay was the crater, and the high craggy mountains surrounding this crater form in several places most remarkable pinnacles, with nearly perpendicular cliffs from their summits to the sea. The highest point of the island, Mount Perahu, is close to the shore on the western side and rises to a height of 2,077 feet. It may be seen from a distance of 55 miles. The next in height is Mount Pokumaru, 1,916 feet. It is on the southern side of the island. Nine other peaks rise to over 1,000 feet and several others to nearly that height.

The mountains on the eastern side of the island are generally either bare or with a growth of stunted trees. On the western side, on the contrary, they are covered with a rich vegetation, and most noticeably with forests of large tree ferns. All the mountain summits not absolutely inaccessible and all the principal passes from one valley to another are commanded by well-constructed, hard, cemented stone forts, generally built in the form of flat terraces, and each commanded by a tower.

Ancient forts.—These constructions are very ancient, and the natives explain their existence by stating that the island formerly contained a numerous population, divided into tribes constantly at war with one another.

Population.—Vancouver estimated the population at 1,500 at the time of his visit, but these intertribal wars must for years have been doing their work of destruction; and further mischief in modern times has accrued to these people by epidemics introduced by European vessels. The present remnant of inhabitants are in appearance a fine, well-made race, strong and industrious, somewhat resembling the natives of New Zealand, claiming to be of Maori blood, and speaking the ancient language of that race, which also closely resembles that spoken at the Gambier Islands and at the Marquesas. The Tahitian dialect is also understood, and forms part of the language of Rapa. The whole native population, in 1892, numbered only about 200, but was said to be then increasing.

The inhabitants are chiefly to be found in three small villages, viz, Ahurei, on the southern side of the bay of that name, where also is stationed the French resident; Area, on the northern side of the same bay; and Tubuai, at the head of the bay in the northern part of the island. There are also a few scattered residences in the different valleys.

Productions.—The taro root is the chief product of the island and grows abundantly; being a water plant, it requires great care in its culture, and, testifying to the extent of the ancient population, the valleys are all arranged in level terraces supported by stone walls, over which spaces the running streams could be turned at pleasure for irrigation purposes. These ancient works are still utilized by the sparse modern inhabitants.

The orange and banana have been introduced, also potatoes and most European vegetables, as also the vine; but coconut trees do not flourish.

The island is overrun by goats, and pigs may be obtained; all sorts of fish and lobsters abound. Sharks also are very numerous.

Coal has been discovered in the northern part of the island, but no attempt at working the seam has been made. A sample of surface stuff tried by a French dispatch boat gave very fair results.

Communication.—A French naval vessel visits Rapa and other islands every three months, taking stores and provisions from Tahiti for the officials.

Winds and weather.—The prevailing winds during eight months of the year, from October to April, inclusive, are from the eastward, but about once in three weeks, during December, January, and February, westerly winds occur for a short period. From May to the middle of September westerly winds, with heavy showers, prevail, blowing in gusts down the valleys of Ahurei Bay. From native report, hurricanes are sometimes experienced, destructive to houses and rooting up the trees. Gales of a cyclonic character, though not common, occur at all times of the year.

Climate.—The climate generally is temperate but moist, rains being frequent and the island often covered with cloud and fog when the weather is quite fine a few miles distant at sea. The temperature seldom rises above 76° in summer or falls below 58° in winter.

Ahurei Bay is a snug anchorage, open to the eastward, about ½ mile wide and 2½ miles deep, the land rising on three sides like the wall of an amphitheater. The entrance is protected by reefs and islets, which effectually prevent the prevailing easterly winds from sending any heavy sea into the harbor; but this same prevalence renders the exit from the harbor very difficult for sailing vessels.

Ahurei Harbor lies in the central portion of the New Zealand and Panama route; although it is actually 500 miles northward of the nearest point of the great circle course, it is the nearest anchorage. and as such was used as a coal depot for the line of steamers formerly between New Zealand and Panama.

Tauna Island, a small sand islet, nearly awash and without any vegetation, bears 112° 800 yards off Nukutere Point, from which runs a shallow bank.

Pilots.—A native pilot boards vessels a little outside Rapa Iti, the high rocky islet almost adjoining the southern outer entrance point. It is advisable to accept his services, the channels being narrow, the currents irregular, and squalls frequent. Firing guns at long intervals will generally bring one on board. It is advisable to do this, especially on Saturdays, when all the boats are away fishing round the island.

Entrance—Depths.—The entrance channel is only 100 yards wide between the reefs, which in places are almost awash, and very intricate, but the depth is great, from 18 to 24 fathoms, with patches of as little as 6½ fathoms.

Directions—Beacons.—The entrance channel through the reefs is marked by beasons arranged as to form and color on the French system. A conspicuous white pyramid beacon stands on Maomao Point and a white triangular iron beacon with globe topmark on the reef extending from that point; these beacons in line 283° lead up to the entrance. Here the reef on the northern side is marked by a red spindle beacon with the usual topmarks. The channel is further marked by five smaller spindles; three, red, on the starboard hand, and two, black, on the port hand. Two white triangular beacons on the shore, about 500 and 600 yards westward of Nukutere Point, in line on a 314° bearing, lead in between the reefs from the first leading line until a white iron tripod beacon with a ball, on the reef opposite Mount Tanga, comes on with the extreme of Kutuni Point 273°, which indicates the turning point and leading line into the harbor. But when abreast of Maomao Point the vessel must edge to the southward to keep in the channel, keeping red beacons on the starboard hand and black beacons on the port hand. When past the white tripod beacon on the shoal a vessel may anchor anywhere, but the water is very deep. Above the village the bay is full of shoals, with deep holes among them.

A black beacon has been erected on a patch of rocks which uncover, situated ½ mile north-northwest of the residency.

A black beacon with cylindrical topmark, 400 yards 27° from the head of the pier at Ahurei village, marks the edge of the reef on the south side of the bay.

Anchorage.—The water within is deep, the space available for anchorage, having from 10 to 29 fathoms, the bottom being coral covered by a thin layer of mud. The squalls from the mountains and high lands are sometimes very violent, though there is little danger of dragging, the anchorage being so well protected.

The best anchorage is with Tapui Island just shut in by Kutuni Point, and the summit of Mangaoa Peak in line with the temple.

On the southern side, at the village of Ahurei, is the landing place, a stone pier, alongside of which there is only 1 foot at low water.

The head of the bay, northwestward of Kutuni Point, is blocked by coral reefs. A conical island of some height, named Tapui, lies at the head, about 200 yards from the beach.

Between Kutuni and Nukutere Points on the northern shore of the bay lies the village of Area at the foot of some small cliffs.

Water may be obtained on the northern side of the anchorage at the foot of a small cascade between Temaranga Point and Area village.

Tides.—It is high water, full and change, at 12h. 10m. Rise of tide 3 feet.

Neilson Reef.—On January 19, 1827, the ship *Sir George Osborne* passed between two portions of this reef, on which the sea broke in places, it being nearly level with the water. White coral was seen under the ship in from 4 to 6 fathoms, and the reef extended a considerable distance, curving to the southeastward in the form of a crescent as far as could be seen from the masthead. In 1831 the ship *Lancaster* struck on this reef, the least depth found being 12 feet.

Position.—The position given by the *Sir George Osborne* was latitude 27° 00′ S., longitude 146° 17′ W.; but in 1895 the French naval vessel *Pourvoyeur* determined the correct position of the eastern point of the reef to be latitude 27° 01′ 30″ S., longitude 146° 02′ 00″ W., which is its position as now charted. It therefore lies about 100 miles westward of Rapa.

President Thiers Reef.—On January 8, 1897, the French bark *President Thiers* obtained soundings of 19 to 21 fathoms on a bank of broken coral and shells extending about 6 miles north-northwest and south-southeast with discolored water some distance from it, and the least depth obtained, 16 fathoms, at the edge of the bank.

The master of the vessel gave the position as latitude 24° 39′ S., longitude 145° 51′ W., and as such it is now charted.

This shoal, therefore, lies about 200 miles northwestward of Rapa and 110 miles eastward of Vavitao Island.

TUBUAI OR AUSTRAL ISLANDS.

Position.—This is a scattered group, consisting of five islands surrounded by fringing coral reefs, generally steep-to. They lie between the parallels 21° 40′ S. and 24° 00′ S. and between the meridians 147° 40′ W. and 154° 45′ W.

Protectorate.—The islands Vavitao, Rurutu, Rimatara, and Tubuai are inhabited and under French protection. Hull Island, or Ile Maria, as it has been named by the French, is uninhabited and is the westernmost of the group.

Winds and weather.—These islands lie near the limit of the southeast trades. East-southeast winds are the most frequent and steady during the year. North and northwest winds generally occur in spring with fine weather, but are often followed by winds from the southwest, which are frequently sudden and violent, veering to south and southeast.

With light northwest winds, if clouds are observed rising from the southward, a sudden shift of wind from that quarter may be expected, which comes up sometimes in furious squalls. These squalls are especially dangerous to vessels from the Society Islands with the wind from northwest, endeavoring to gain the region of variable winds.

Hurricanes are felt among the Tubuai Islands, where they blow with great violence, and follow the usual law in the Southern Hemisphere; they are experienced during the summer months, especially in March.

The climate is mild and temperate. The seasons are well marked, and with southerly winds the temperature is fresh in winter. The heat in summer is never excessive. The inhabitants of the four islands numbered about 700 in 1892; they are of the Maori race, and speak almost the same language as the Tahitians. They are Christians, and mostly Protestants.

Products.—The principal production of these islands is taro, the root of an aquatic plant, and a substitute for the indigenous breadfruit of the Society Islands which does not flourish here. The taro-root kneaded and slightly fermented is exported to the Tuamotu Archipelago under the name of tivo or popoï. The manoic, arrowroot, cotton, tobacco, and sugar cane grow well; bananas, oranges, and yams may also be obtained. Many pigs, fowls, turkeys, and horses are reared here, and there are also goats in a wild state.

Vavitao (lat. 23° 52′ S., long. 147° 41′ W.), also called Ravaivai Island (High Island) is about 400 miles south by east of Tahiti, and was discovered on October 23, 1791. It is about 12 miles long in an east by north and opposite direction, with conspicuous high rugged hills, mostly covered with trees, and generally terminating with a gentle slope toward the shore. The population in 1902 was about 300.

Barrier Reef.—The island is surrounded by a barrier reef, the outer part of which lies nearly 1 mile from the land and is mostly awash, with numerous wooded islets, especially on its southern and eastern parts; the eastern side of the reef extends seaward in a gradual slope; off the southwestern part are from 10 to 15 fathoms. On the western part of the reef is an islet, which will be seen standing out from the mainland, when approaching from the North.

Entrances—Depths.—Two passages through the reef, both on the northern side of the island, give access to the waters within. They are named the Tetobe and Totoro Ahau Passes; the first only is of importance. The Tetobe Pass is about 2 miles northeastward of the western islet described, and is the only ship passage to the anchorage. It is about 1 mile long, and was deepened to 12 feet in 1904 for a width of 197 feet. Entering the pass, a sharp lookout from the masthead is necessary to avoid the shoal heads, and a sailing vessel should be under easy canvas. When within the Barrier Reef there is a deep-water channel completely round the island. The commander of the French naval vessel *Zélée* reported the main channel to be much obstructed with coral patches, and that it must be navigated to a great extent by eye; also that it is dangerous to attempt it when the swell is running in the channel, which, however, is not often the case.

Directions.—The commander of the *Zélée* had some beacons erected and gives the following directions for entering. Steer for two triangular beacons in line bearing 139°. On this line Mount Hiro is just to the right of Tehoro.

Next steer 163° for the white marks in line, one of which is on Ruatara, a great block of rock. Then steer 194° for the fall of Taraia, a conspicuous hill in line with a pyramid on its slope; this leads between a rock awash and a 5-foot patch.

Next steer 220° for the pointed suppit of Tapioi in line with the temple of Manhanatoa. Then, with the white pyramid on Motu Tuitui in line with a white pyramid 700 yards 81° of it, and with Tehoro astern, in line with a conspicuous opening in the first islet on the eastern reef of the channel; this clears several dangerous heads and leads up to abreast Vaianuana Peninsula; after passing an anvil-shaped rock off that, the edge of the reef may be followed to the anchorage.

Vessels drawing over 11 feet should, if possible, wait for high water.

Pilot.—Strangers wishing to enter should obtain a pilot.

Anchorage.—Ships may anchor within the entrance on the westside of the pass, off the village of Mahanatoa, but with winds northward of east a heavy sea rolls in, and with north or northwesterly winds it would be an unsafe anchorage. Eastward of the pass, and nearer the reef than the land, the anchorage is better at all times, but there would be some danger to a large vessel in attempting to reach it, as, with the prevailing winds she would probably have to tack between the reef and the shore.

Raiurua.—At the western extreme of the island is the large deep bay of Raiurua, affording excellent anchorage in all winds; it can only be reached with safety by steamers. At Raiurua there is a stone wharf where a vessel of from 9 to 10 feet draft can lie alongside. During easterly winds heavy squalls off the hills make boat work dangerous.

In the northern part of the island is the anchorage of Anatonu.

Raiurua—Rock.—A rock, with a depth of 2¾ fathoms, is situated in this anchorage, at 450 yards northwestward of the outer extremity of the wharf.

Tidal streams.—It is high water, full and change, at 11h. 12m. Springs rise 2 feet 4 inches.

In the channel the current runs out almost constantly, and during the ebb sets to the north by west.

In the outer anchorage the flood sets to the eastward and the ebb to the westward with sufficient force to swing a ship across a strong breeze.

Climate.—The climate is very healthful and the temperature in the winter falls as low as 52° F. The best months are September and October.

Products.—Besides the ordinary tropical produce coffee is now cultivated and is of excellent quality; in 1901 the crops produced amounted to 20 tons. Rosewood and sandalwood perfumes are made.

Water.—Care should be taken that water is not drunk from streams that flow through taro plantations. The best watering place is eastward of the village of Anatonu.

Provisions.—There are pigs, goats, fowls, turkeys, and ducks, besides wild duck and snipe.

Communication.—The mail packet of the Tubuai Archipelago calls here eight times a year.

Pilots.—Natives offer themselves as pilots, but little confidence can be placed in them.

Tubuai (lat. 23° 22′ S., long. 149° 28′ W.), about 96 miles westward of Vavitao was discovered in 1777, and it was upon this island that the mutineers of the *Bounty* tried to settle in 1789, but quarrelled with the natives and left. The island is high and of oblong form, well wooded, and about 5 miles long north by east and opposite direction by 3 miles wide; from the northward or southward it shows as two islands, which, on a nearer approach, are seen to be joined by low land. The land in the eastern section attains its greatest altitude in Mount Taita, which rises to a height of 1,309 feet, and in its western section in Mount Tonarutu, 1,024 feet. Several other peaks are of considerable height.

Barrier reef.—Tubuai, like Vavitao, is surrounded by a barrier reef, partly submerged, but rarely with so much as 6 feet over it, of which the outer edge varies from 1 mile to 3 miles from the shore, the least distance of the reef from the shore being on the northwestern side, and the greatest on the southeastern side of the island. On the northeastern part of the reef are several islets, and on the northwestern part is a large opening which forms the pass leading inside the reefs. There is a passage between the Barrier Reef and the island, but incumbered by innumerable coral patches.

Mataura—Mahua.—A little eastward of the entrance pass is the village of Mataura, where the chief of the island resides, and his flagstaff is a prominent object; on the southern side is the village of Mahua, with a good road connecting them. There are several other small hamlets around the coast.

Population—Trade.—The population, according to the census of 1892, amounted to 420. There is some little trade between this island and Tahiti.

Shoal.—A shoal of small extent, having a depth of 4¼ fathoms, exists in the approach to Mataura Anchorage. From it the black beacon on the rock bears 145°, distant 1,750 yards.

Entrance—Anchorage—Directions.—The principal pass through the reefs is from the northward, and lies about 1 mile westward of the village of Mataura; it has from 3½ to 8 fathoms water, but is encumbered by rocky heads, several of which are marked by beacons. Two beacons at the head of the pass, one on the shore, a white triangular sheet-iron plate fixed to the trunk of a tree, the other a beacon with a white conical topmark, on a reef in front of it, when in line 157°, form the leading line, but for the best water the chart should be consulted. The depths at Mataura Anchorage have changed from those shown on the chart, and there are numerous rocky heads between the bank marked by the second black beacon and the shoal 200 yards to the northward of it. The sharp turn between the black and red beacons can be more easily taken by opening the leading marks freely, but only just before arriving at the turn. A notch between two moderately high peaks on the western part of the island, bearing 179°, leads up to the entrance until the leading beacons come in line, and also to the outer anchorage, which is off the entrance of the pass, about 600 or 800 yards outside the reef.

The anchorage formerly indicated is encumbered with coral patches, and it is now recommended to anchor in 3¼ fathoms, with the flagstaff 99° and the finger of Pahatu Peak 209°. The holding ground is poor, and as the ship always swings broadside to the swell, is not comfortable.

Caution.—In bad weather this anchorage is only safe with winds between south and east-northeast; in fine weather, with the wind anywhere around south between southwest and northeast; but with the wind from the northward it is most unsafe. The holding ground is bad, the bottom being coral covered with a thin layer of mud.

Passes.—Westward of the main pass is the pass of Vapea, deep, but so narrow that it is only used by small craft passing outward through the reef. At the southwestern corner of the Barrier Reef is another small opening called the Pass of Hue, used by small craft in fine weather. From this, around southward and eastward to the isles on the northeast, the Barrier Reef is without a break, but between those isles and the main pass are several small-boat openings.

The main entrance pass is, however, the only one that can under any circumstances be taken with safety by vessels of more than 40 tons. When inside the Barrier Reef the island may be circumnavigated by small schooners with the aid of perfect local knowledge.

Mataura Anchorage is within the Barrier Reef off the village of Mataura; it furnishes an anchorage for steamers up to 12 feet draft. When half way in by the main pass, a black beacon 13 feet high, on a rock which dries, has to be left on the port hand, passing around which a red beacon is left on the starboard hand and a second black beacon on the port hand.

Current.—A westerly current of from 2 to 3 knots prevails at the anchorage; also the swell from the offing enters by the cuttings of the Barrier Reef.

Pilot.—Any stranger wishing to take up this or any other inner anchorage should not enter without a pilot.

Moses Reef (lat. 22° 47′ S., long. 151° 13′ W.).—This reef (the existence of which was considered extremely problematical) is stated by a resident of Rurutu to be situated at a distance of 18 to 20 miles 162° from Rurutu Island; it is about ¾ mile long in a northwesterly and southeasterly direction, and has a least known depth of 9 feet over it.

In bad weather the sea breaks over this reef. This is probably the reef on which the bark *Henry* was reported to have been lost about 1873, on which there was stated to be a depth of 11 feet, situated in a position about 20 miles southeast by south from Rurutu Island.

Rurutu or Oheteroa (lat. 22° 27′ S., long. 151° 21′ W.), situated 115 miles westward of Tubuai; it was discovered by Cook on August 14, 1769, during his first voyage. It is between 6 and 7 miles long north and south, 3 miles wide at the northern part, and volcanic in appearance; the mountains attain a height of 1,300 feet, the lower parts being wooded.

The reef which surrounds the island is nearly contiguous to the shore. There is a small port, fit only for small craft of from 40 to 50 tons on the northeastern part of the island, and a passage on the southeastern side fit for boats only, in fine weather, as also the bay presently described.

Population—Natives.—The native inhabitants numbered in 1907 about 847; they are stated to be Protestant, formerly under the direction of the London Missionary Society, to be good natured and intelligent, and to have some knowledge of shipbuilding and navigation.

Landmarks.—Approaching the island from the northward the most conspicuous objects are the church (a white building without a tower) and some white houses, among which is the two-storied house of the chief, in front of which is a high flagstaff.

Supplies.—Pigs, fowls, water, as well as vegetables and fruit in limited quantities, can be obtained.

Avera Bay.—Near the middle of the western side of the island is Avera Bay, 2 miles deep, which is a safe and convenient anchorage during the prevalent easterly winds. The bottom is first seen at about 1,000 yards from the surrounding reef. Sailing vessels can easily enter this bay, and the water, though deep, is free from dangers. There is an opening through the reef at the head of this bay, which can be used by vessels of about 70 tons; it is marked by a post in the coral rocks, which post has to be left on the port hand in entering.

There is a coral plateau in the bay with depths of 8 to 19 fathoms on it, where a small vessel may anchor in fine weather. The *Aube* anchored here in 11 fathoms with the temple at Avera bearing 60°, the south point of the bay 176°, and the north point of the bay 322°.

Moerai.—The seat of government is at the village of Moerai, on the northeast coast. There are two boat channels through the reef in this bay, one just opposite the village and the other ½ mile to the southeastward; they are tortuous, and as a strong current to the northward sets across the entrances, boats should always employ a steer oar when using them.

The anchorage off the village is not safe while the trade wind is blowing strongly.

Rimitara (lat. 22° 40′ S., long. 152° 45′ W.), lying 77 miles to the west by south of Rurutu Island is a small island about 2 or 3 miles in diameter and rising to a height of 315 feet in the center. It had in 1907 a population of about 411; the principal village, Amaru, is on the eastern side. A coral reef closely surrounds the shore, through which there is a small opening on the eastern side, never accessible even to boats, with an easterly wind, and two small openings on the northern side, of which the easternmost is the best. The natives say that schooners of 50 tons have been launched and sent to sea by this narrow passage. The island can, however, be approached only in favorable weather, when landing may be effected either by the northern channel or opposite the villages on the eastern and western sides, according to the direction of the wind, but not at the village at the southern end.

The island is thickly wooded; depths of from 5 to 20 fathoms are found at distances of 300 to 400 yards outside the fringing reef, affording anchorage in fine weather, over a bottom of sand and coral.

Supplies.—The natives export a small quantity of coconut oil and cotton, rear pigs and fowls, and cultivate vegetables and fruit, all of which may be obtained at reasonable prices if the weather admits of communication with the shore.

Hull Islands or Ile Maria (lat. 21° 49′ S., long. 154° 43′ W.).—These, the westernmost of the Tubuai Islands, first reported by the whaler *Benjamin Tucker*, in October, 1845, and formerly called Sands Island, but now named by the French Ile Maria, is a group of four small islands on a coral reef of triangular form, with its longest side northwest and southeast, along which are three islands within a distance of about 3 miles, the fourth island lying at the apex of the triangle 2 miles northeast of the center one. The highest of the islands is 66 feet in height, and all are more or less wooded.

These islands have been leased for the cultivation of coconuts and the manufacture of copra, for 99 years from January 1, 1902, to Levers Pacific Plantation Co.

Reef.—The reef surrounding the islands appears to have no opening, and within the reef the water is shallow, the bottom being distinctly seen from outside.

Landing is generally impracticable on account of the surf.

COOK ISLANDS.

(Lat. 18° 48′ S. to lat 22° 00′ S.; long. 157° 20′ to long. 160° 00′ W.)

General remarks.—This group lies scattered over a considerable space. There are 9 or 10 separate islands; the greater number were discovered by Cook, and the whole are included in the Dominion of New Zealand.

Missions—Natives.—The Cook Islands are generally healthful and the natives seldom suffer from epidemics. The natives of all this group are much darker than the Tahitians, and many of the islanders have a Mongolian type of face; they have been converted to the Protestant form of Christianity, and resident missionaries of the London Missionary Society are stationed at Rarotonga, Mangaia, and Aitutaki. The people of the last-named island speak the same language as those of Rarotonga. The houses are built of coral, whitewashed, with thatched roofs, and present a very picturesque appearance from the sea.

Winds.—These islands being so near the limit of the trade winds, steady southeasterly breezes must not be expected; but they are most frequent between May and October, both included; during the remainder of the year, southwest and westerly winds, which often blow as gales for several days in succession, are frequent, and cause a heavy surf on the western or usually lee sides of the islands.

Hurricanes occur about once in seven years, but these storms are very local; the worst months are from December to March, inclusive. Commencing generally at from northwest to north, and ending at southeast, they do immense damage.

Currents.—In the vicinity of this group the current will generally be found setting to the westward, at the rate of about ½ mile an hour, but much influenced in rate and direction by the force and direction of the wind.

Mangaia (lat. 21° 55′ S., long. 157° 56′ W.), the southernmost island of the group, was discovered by Cook on his third voyage, March 30, 1777. It is of volcanic origin, about 30 miles in circumference, and otherwise differs from most of the south Pacific islands. It is 656 feet high, and at a distance appears almost flat; there is a fringing reef all round, extending from 50 yards to 400 yards from the shore, and about 2 feet above high-water mark, but there is no passage through it.

Vessels can approach the edge of the reef to within 200 yards, as there are no outlying dangers, but there is no anchorage, the reef being steep-to everywhere.

There is a landing place, not often used, on the north side of the island.

The landing off Ivirua is difficult to find.

Landing.—The method of communicating with the shore is as follows: Boats anchor outside the reef, on a ledge on the western side of the island off the principal village, Oneroa, and large canoes come off for passengers, etc.; the natives then look out for the rise of the swell and land the canoes on the reef, jump out quickly, and drag the canoe across the reef to land before the receding sea can sweep it back into deep water.

There is always, even in the finest weather, some swell on, and it is not always safe to attempt a landing; few accidents, however, occur. With westerly winds it is best to land on the eastern side of the island about 3 miles from the northern point; the places may be known by a cutting in the cliffs and by a corrugated iron building and three huts on the shore. The method of landing is the same as at Oneroa.

Aspect.—The village of Oneroa is most conspicuous, the church, school, and a long wall in front, are very white and show up at a long distance. A missionary and his wife and five European traders were living on the island in 1900.

Climate—Population.—The climate is good and the island healthy. The population numbers about 2,000, of whom half live near the mission station of Oneroa; the remainder are distributed between two other villages, Ivirua and Tamarua, each of which has its church and school; they are intelligent and industrious, and are governed by a chief residing at Oneroa.

Communications.—About a dozen schooners visit the island annually from New Zealand, Tahiti, and Rarotonga, and export coffee, cotton, copra, and tobacco.

Supplies.—Pigs, poultry, yams, sweet potatoes, and pineapples can be obtained, but it is necessary to go 3 miles inland for water. Horses are in use on this island.

Rarotonga (lat. 21° 12′ S., long. 159° 47′ W.).—This island, lying about 100 miles westward of Mangaia, is 6 miles in length, 3½ miles wide, and is surrounded by a fringing reef, which, however, is not so entirely without breaks as at Mangaia, nor is it steep-to. The principal settlement, Avarua, is on the northern side, where are the two harbors presently described. On the eastern side are the villages of Matavera and Ngatangua; at the latter is a little harbor where small vessels are built, and where there is good landing in westerly winds. On the southern side is the village of Tatikaveka; and, on the western side, Arorangi. In appearance the island somewhat resembles Tahiti, with the mountains rising up into pinnacles and fantastic peaks, and covered with vegetation.

Mountains—Water.—It is distinctly a volcanic island and has a back cone of lava running southeast and northwest across it, touching the sea near Muri and at Black Rock, respectively.

The mountains Ikurangi, 1,560 feet, Te Atu Kura, 2,100 feet, Te Mahanga, 2,100 feet, and Te Kohu, 1,950 feet, are, with the exception of the latter, exceedingly precipitous, and it is only possible to reach the summit by one or two razor-backed ridges. Te Kohu is, however, easy to climb, and on the flat top is a spring of water which is said to be the source of the Avana Stream. The island is well watered, for there are numerous creeks, most of which do not run out to the reef, but lose themselves in the coral sand zone that fringes the island. The soil is distinctly good, and there must be not less than 10,000 acres capable of cultivation.

There is a good coast road round the island.

Observation spot.—The observation spot on Tekarae Point, on the northern side of the island, is in latitude 21° 11′ 35″ S., longitude 159° 47′ W.

Tidal wave.—On December 30, 1904, a very heavy sea arose, with a long rolling swell from the northwestward. The water rose about 70 feet above the level of high water, remaining for some hours above that level, and destroying houses, property, and all vegetation on the western part of the island, but no lives were lost.

This disturbance occurred earlier at the Fiji Islands, and was most severely felt at Aitutako and Manuai Island.

Climate.—The climate as a tropical island is probably the most healthful and finest in the world. During the summer months, viz, from December 1 to March 31, the temperature averages about 84° by day and 74° by night. During the cool months, July to October, it is about 8° lower.

The rainfall averages about 73 inches. Most of this falls in the summer months. High winds are seldom felt. In these islands of the south seas endemic disease is unknown. The people suffer from diarrhœa in a bad form occasionally, but epidemics can almost always be traced to the visit of some vessel. Fevers are unknown, and elephantiasis is the only disease in which the mosquito is supposed to play a part.

Products—Trade.—Coffee of good quality is grown. The imports consist of cloth, hardware, provisions, lumber, and iron, etc.; the exports consist of copra, coffee, lime juice, oranges, pineapples, etc.

Communication.—The island is in fortnightly communication with Auckland, and telegrams have been received from London in 12 days. About 40 sailing vessels and 30 steamers call annually, including a small local steamer trading among the islands.

The deputy commissioner resides at Avatiu, in Rarotonga. The London Missionary Society has an institution at Avarua for the education of native missionaries, many of whom have been sent to the outlying stations at Manahiki, Rakahanga, and Puka Puka Islands, lying to the northward of this group. In 1895 the population of the island numbered about 2,700, including about 50 Europeans.

Avarua.—There is anchorage off Avarua, in from 10 to 15 fathoms, about 400 yards outside the reefs; it is protected from southeasterly winds by the northeast point and the reef off it, but should the wind shift to the northward a swell sets in, and it would not be safe except for a steamer with steam ready.

Landmarks.—A large shed with red roof is situated close to the pier.

A number of houses and stores are situated between Avarua and Avatiu.

Beacons.—Two red posts, which, when in line, bear 177°, have been erected on the pier, and two pole beacons, the inner surmounted by a white triangle, and the outer by a white square, have been erected on Puee Point; when in line these beacons bear 100°.

Lights.—When the arrival of a vessel is expected lights are exhibited from each of the pier beacons, and from each of those on Puee Point.

Caution.—Sailing vessels standing off and on should be careful not to get too close inshore, especially westward of Avarua, as there is a considerable set onshore, and several ships have been wrecked, there being deep water and no anchorage close to the edge of the reef in that part, though as a rule there are anchorage depths around the island.

Directions.—Vessels approaching should bring the beacons on the pier slightly open of each other to the westward, or the Government flagstaff in line with the wharf, bearing 177°, until the beacons on Puee Point are slightly open of each other to the northward, bearing nearly 100°, when anchorage is found in a depth of from 16 to 20 fathoms.

The charted depths are unreliable.

At night, care should be taken not to mistake the lights of the town for the leading lights.

A fixed white light is exhibited from the pier when the mail steamer is expected.

Moorings are laid in the harbor for small craft, but no vessel of 100 tons can enter.

Coal.—Coal is not kept in stock.

Population.—The population of Avarua in 1907 was 847.

Supplies.—Native cattle can be obtained, but the meat is not good. Occasionally sheep may be had. Vegetables are scarce, but good bread is obtainable.

Water.—Fresh water can be obtained in lighters holding about 5 tons.

Boat passage.—There is a good boat passage through the reef into a shallow lagoon opposite the mission house at Arorangi.

Avatiu Harbor is very confined, but is sheltered from all winds except those from the northward; even with those winds the danger is not from the sea raised by the wind, but from the rapid current which sets out, caused by the rush of water over the reef on either side of the entrance.

The British naval vessel *Cormorant*, of 1,130 tons, went into this harbor in November, 1887, and secured head and stern by chains laid to anchors on the reef and kept there for that purpose. When going in the vessel's bow should be run close to the weather side, whichever it may happen to be, the stern swung around and secured as above mentioned. By this means the vessel lies head out and can slip everything on approach of bad weather and proceed to sea. The local trading steamer always secures in this manner, but there is only room for one such vessel.

The harbor is considered safe from April to November; after that northerly gales are apt to spring up suddenly, when a vessel might have to go to sea at night.

Pier.—A pier has been constructed at this harbor and moorings for small vessels established.

Caution.—When anchoring in the roads care must be taken to let go the anchor directly the right depth is obtained. The water shoals suddenly, and the vessel is liable to be backed into very deep water. In entering the harbor, there is a small coral patch with 2 fathoms over it at low water just off the western side of the entrance, the position of which was not ascertained, but which vessels must be careful to avoid.

Mauki Island (lat. 20° 7′ S., long. 157° 22′ W.), the easternmost of the Cook Group, is low and wooded, about 2 miles in diameter and nearly circular, the tops of the trees being estimated at 120 feet above the sea, which render it visible from the masthead from a distance of about 17 miles.

No anchorage.—Mauki Island is reported to have no anchorage, but canoes come off in fine weather to communicate with passing ships. The fringing reef does not appear to extend beyond 1 mile from the shore; the western side is clear of dangers, and may be approached to within 400 or 600 yards. The landing place is on the western side, close to a flag staff and immediately below a house almost hidden by trees.

Population.—The only village, Nukuao, is more than 1 mile from the landing place, and the church is a fine specimen of native work. The natives are a fine race, pleasant in face and merry in disposition. They number about 400. The island produces copra and cotton for export, for which a schooner from Auckland calls at regular intervals.

Mitiero Island (lat. 19° 49′ S., long. 157° 43′ W.), which lies about 22 miles northwestward of Mauki Island, is small and covered with verdure; near the center is a clump of trees, the tops of which are 92 feet above the sea, visible from the masthead from a distance of about 16 miles.

It is surrounded by a barrier reef, outside of which are apparently no dangers; and there is no anchorage. On the western side is a hut and flagstaff among the coconut trees which marks the landing place through the reef, but the surf is too heavy to admit of ships' boats using it.

Population.—In 1888 the population numbered 275, chiefly resident in the village of Nukutere. A small quantity of copra and cotton is exported. A hurrican visited the island in November, 1890, destroying many huts and coconut trees, but it does not appear to have been experienced in other islands of the Cook Group.

Atiu or Vatiu Island (lat. 19° 59′ S., long. 158° 06′ W.), discovered on March 31, 1777, is about 20 miles in circumference; the highest point is 394 feet above the sea and lies about 42 miles west of Mauki. The formation of this island much resembles Mangaia, and a reef closely fringes the shore, extending in no place more than 1,000 yards; there are no outlying dangers.

Aspect.—The northern side presents a bold rocky cliff shore about 30 feet high, intersected by small sandy bays between the rocky heads. On the cliff above these bays some roads may be seen, cut through the jungle into the interior. This island is everywhere thickly wooded, the hills slope gently from the summits, and the valleys, as a rule, extend in an east and west direction. There are two landing places for canoes on the western side, the other about 2 miles farther to the northward; the landing place is marked by a roadway and a few huts. On the eastern side there are also two landing places, with westerly winds, both indicated by sandy beaches, one just southward of the northeast point of the island, the other southward of the east point; the eastern landing places are very difficult.

Population.—The village of Natikitea, with its church, shows conspicuously on the top of the ridge about 1½ miles from the principal western landing place. There are two other villages, viz, Natipa, in the north, and Niaurau, in the south. The population of the island is about 800.

A considerable number of vessels call here, and temporary anchorage for small craft may be obtained on a small patch, in 16 fathoms, on the northern side of the island, but no vessel should remain here at night.

Exports.—Copra is the principal export, but coconut, coffee, cotton, bananas, limes, pineapples, and oranges, are grown also.

Takutea, also called Fenua Iti (lat. 19° 49′ S., long. 158° 16′ W.), about 11 miles northwestward of Atiu, is a small uninhabited island about 3 miles in circumference, with a white coral sand beach protected by a fringing reef; it is well wooded with coconut palms and other trees, the tops of which are about 80 feet high, and render it visible as far as the landing place at Atiu. It is reported to be without water.

A reef, with occasional heavy breakers, extends 1¾ miles from the southeastern point. There is no anchorage, and the only place where landing appears practicable is on the northern side, where there is a barrier reef close to a few ruined huts.

Hervey Islands (lat. 19° 18′ S., long. 158° 57′ W.) were discovered by Cook in 1773. They are about 45 miles northwestward of Takutea, and consist of two small low islands named Manuai and Auotu lying 1¾ miles northeast and southwest of each other, having a lagoon between them, and being surrounded by a coral reef through which there is no passage. The greater part of the lagoon is occupied by coral reefs with deep water in parts between them.

These islands are well wooded, the tops of the trees being about 60 feet above the sea. The settlement is on the northwestern side of Manuai, the southwestern island, where there is landing through a small and shallow passage in the reef. There are about 25 inhabitants, whose occupation is collecting and exporting copra for the Chief of Aitutaki, who claims these islands. A few fowls and pigs may be obtained.

Temporary anchorage.—There is no safe anchorage. With offshore or light winds temporary anchorage can be found off the northwest point of Manuai in a depth of from 9 to 12 fathoms, at about 200 yards from the reef.

From this anchorage the copra shed bears 156°, and the extremity of the reef bears 55°.

Aitutaki (lat. 18° 52′ S., long. 159° 46′ W.), the northwestern island of the Cook group, lies about 55 miles westward of the Hervey Islands, and was discovered on April 11, 1798, by the *Bounty*, a few days before the mutiny.

It is 4 miles long, north and south, with a ridge extending through it. The highest peak, bare, except for a few coconut trees, and 450 feet in height, is near the northern end; and on the northwest side is Bluff Peak, with a remarkably steep rocky cliff 200 feet high, facing the sea; the extreme northern end is low and swampy.

Population.—In 1892 the population was about 1,500, and was said to be decreasing at the rate of about 40 per annum. The island is well watered, thickly wooded, and could easily support a much larger population, the climate being healthful; the people are hospitable and well disposed.

Government.—The island has its own form of government under the authority of the deputy commissioner at Rarotonga, by whom also the post office and customhouse authorities are appointed.

Barrier reef.—Aitutaki has at its northern end only a fringing reef; the island resting its northern end, in fact, on a reef which on both sides and to the southward quits the shore of the island and becomes a barrier reef, through which there are only boat passages, the principal one being opposite the mission station at Arutunga, on the western side of the island.

The barrier reef is in the form of a triangle, and extends from the northern end of the island, 7 miles to the southeastward, 6½ miles to the southwestward, and its southern end or base is 6½ miles long, west and east. On the outer edge are eight islands, covered with trees, from 20 to 60 feet high, and six low sand cays upon which the sea breaks heavily.

Maina—Motikitiu.—The small wooded island Maina, 40 feet to tops of trees, stands on the western elbow of the barrier reef, and similarly the small island Motikitiu, with several larger ones close adjacent, at the southeastern elbow. None but the main island of Aitutaki are inhabited.

Outside the reef are no outlying shoals, and the edge is well marked by breakers and by rocks above water.

The lagoon within the barrier reef is thickly studded with coral knolls, among which are depths of from 3½ to 4 fathoms.

Arutunga anchorage.—The only anchorage is off the boat passage on the western side, off Arutunga, with the church bearing 142°. With the anchor in 15 fathoms and 45 fathoms chain out, there are only 120 yards of swinging room. A steamer with steam ready could lie here from April to November, the season of easterly winds. The British naval vessel *Champion* remained here eight days in June, 1892, and only once tailed toward the reef.

Sailing vessels never attempt an anchorage, but always stand off and on.

Boat passage.—There is a double boat passage at Arutunga, the entrances being about 400 yards apart; the northeastern is the true passage, and is at first from 26 to 30 yards wide for about 150 yards, with a depth of 2¾ to 3 fathoms; it then shoals to 4 feet for another 100 yards; from thence a channel not more than a boat's length wide, with from 2 to 6 feet water, leads up to the pier, a rough stone structure with only 2 feet at its head. A strong stream always runs out through the passage, sometimes as much as 5 knots.

The natives state that formerly there was sufficient water inside for schooners to lie at anchor, where now there are only 3 feet.

Tides.—The extreme range of tide is only about 2 feet and the rise at neaps is not more than 1 foot. It is high water, full and change, at about 8 hours, but the tide depends greatly on the wind.

Mission.—The missionary establishment at Arutunga consists of two white buildings, the church and schoolhouse. One white missionary and four white traders were resident on the island in 1892.

Supplies—Trade, etc.—Pigs, fowls, fruit, etc., may be obtained at moderate prices, and there are a few cattle of a small but good-looking breed on the island. Water may be obtained at the pier. The principal exports are copra, cotton, arrowroot, bêche de mer, coffee, and oranges; about 100 tons of various goods are imported.

Communication.—The Union Steamship Co.'s steamers call here occasionally.

Wind and weather.—From January to April is the rainy season, when also hurricanes may be expected. From April to November easterly winds prevail. After November northwesterly winds may be expected.

Palmerston Islands (lat. 18° 04′ S., long. 163° 10′ W.).—These islands lie about 200 miles westward of Aitutaki. They were discovered on June 16, 1774. They consist of eight sandy islets on a coral reef 4½ miles in extent north and south by 2½ miles east and west, inclosing a lagoon; of the islets, those on the southern half are covered with shrubs and palms, but the northeastern islets, being low and without vegetation, are very dangerous at night.

Strong and variable currents exist in the neighborhood of these islands, attaining, by report, a velocity of 7 to 8 knots near the islands, rendering the neighborhood dangerous.

Anchorage.—In fine weather anchorage in 10½ fathoms, coral bottom, may be found at a distance of 400 yards from the reef, on the prolongation of the western point of the reef extending from the most western island of the group.

Very strong currents are found in the boat passage, especially during the ebb.

Leased.—In 1891 Palmerston Islands were leased to a British subject for 21 years from January 1, 1892. They are now included in the Dominion of New Zealand.

Population.—When visited by the British naval vessel *Goldfinch* in 1891 the total population amounted to 35, all of whom lived on the southwestern islet. Nothing in the way of supplies could be obtained except coconuts and fish.

Gales.—This group of islets was visited by a severe storm in December, 1883, which destroyed all the coconuts. The inhabitants report that heavy gales occur nearly every year, generally in January and February, blowing from northeast and east, lasting from 24 to 36 hours, and as a rule not shifting from that quarter. The coconut trees being all much bent to the westward tend to confirm this.

Anchorage—Passes.—Northward of the westernmost island there is a narrow passage, and about 1 mile northeastward of it is a wider passage, said to have about 8 feet water in it. There is anchorage in 9 fathoms, coral, about 100 yards from the reef abreast of the southern boat passage. Small schooners occasionally visit the islands for copra, mooring off the southern boat passage.

Antiope and Beveridge Reefs.—Nearly 300 miles westward of Palmerston Islands are the Antiope and Beveridge Reefs, which may be considered as outlying reefs of the Friendly Islands, and will be found described in Pacific Islands Pilot, Volume I.

CHAPTER III.

SOCIETY ISLANDS.

(Lat. 15° 40′ S. to lat. 17° 55′ S.; long. 148° W. to long 154° 50′ W.)

Society Islands—General information.—This important double group of islands consists of the celebrated island Tahiti and several smaller islands in the southeastern or Windward Group and of Huaheine, Raiatea, and other islands in the northwestern or Leeward Group. There is but little doubt that Tahiti was first seen by Quiros in 1606, but, like many other Spanish discoveries, it was unknown or unnoticed by the rest of the world, so that when the *Dolphin*, sent by George III to make discoveries in the South Seas, reached it on June 19, 1767, it was supposed to be a new discovery, and named King George Island.

The *Dolphin* sailed along the eastern side and anchored off the northeastern shore. On the 23d Matavai Bay was discovered, and, in passing it, struck on the Dolphin Shoal; the ship was, however, got off safely and anchored in the bay. A landing party took formal possession in the Name of George III by hoisting a flag. On April 2, 1768, the island was visited by the frigate *Boudeuse* and a store ship, leaving on the 14th, and naming it Nouvelle Cythere.

The next visit was the most important, as it made the world more intimately acquainted with the group than did the former ones, besides filling important vacancies in science.

It had been recommended that the rare occurrence of the transit of Venus across the sun's disk should be observed at points as far apart as possible. For this purpose an efficient staff of scientific observers was sent in the *Endeavour* to make the necessary observations. They arrived at Matavai Bay on April 12, 1769, and on the 3d of June following the transit was observed near the north point of the island, which thus became one of the best determined positions in the Western Hemisphere and was named Venus Point.

The chief island (then spelled Otaheite) was surveyed by Cook and the northwestern group discovered and given the name Society Islands; the others, including Tahiti, were named the Georgian Islands. The name Society Islands now applies to and includes both groups, but by those trading among them they are distinguished as the Windward and Leeward Groups.

In 1772 the Spanish Government dispatched an expedition to Tahiti; on returning, the report caused an attempt at colonization to be made, and in 1774 missionaries were sent to establish a settlement.

Subsequent events concerning the islands are generally known; eleven years passed without any intercourse with Europe, when the *Bounty*, having been sent by George III to transport breadfruit trees to the British West Indies, arrived at Matavai Bay on October 26, 1788. The subsequent mutiny and return of the mutineers to Tahiti on June 6, 1789, and again on September 22, 1789, is a matter of history.

The *Pandora* sloop, sent in search of the *Bounty* and her mutineers, arrived at Tahiti on March 23, 1791, and took away those who had remained, fourteen in number. The *Pandora* was, however, wrecked near Torres Strait when returning to England.

Most of the great voyagers to whom we owe our knowledge of the Pacific have made this point.

Missions.—The London Missionary Society sent missionaries to Tahiti in 1797 to convert the aboriginal inhabitants to Christianity, and after twenty years their efforts were crowned with success, the whole population renouncing paganism. This society still has mission stations at Huaheine, Raiatea, Bora Bora, and Maupiti, and the great majority of the inhabitants are Protestants. In Tahiti and Murea there are about 2,000 Roman Catholics.

Government.—The most prominent chief, Pomaré, who supported the missionaries, soon acquired a marked ascendency over the other chiefs, and he was eventually declared king of the Society Islands and their dependencies at Pomaré I. He died in 1803.

His son, Pomaré II, after several wars, succeeded in thoroughly establishing himself, but died comparatively young, in 1821, and was succeeded by Pomaré III, a child only one year old, who died when only seven. He was succeeded by the celebrated queen, Pomaré IV, who reigned actually for many years, and nominally until her death, in 1877. On that event occurring, she was succeeded by her son, Pomaré V, destined to be the last king of these islands.

Annexation to France.—In 1842, on account of affronts to and the expulsion of French missionaries, the frigate *La Venus* obliged Queen Pomaré to sign a treaty allowing liberty to all French subjects; and in 1844 a strong force was landed and hauled down Queen Pomarés standard and hoisting the French flag took possession of the island in the name of Louis Philippe, King of France. Thenceforth a French protectorate over the Windward group existed until June, 1880. In that year the kingdom of Pomaré V and its dependencies were formally annexed to France and the King ceased to reign. In 1887, by a convention with the English Government, the Leeward Group was also assigned to France and was taken possession of by that Government in March, 1888.

Inhabitants.—The natives of the Society Islands are all known as Tahitians and are renowned for their beauty and vigor; they are of a yellowish olive complexion, dark in those exposed to the air and sea, but very clear and fair, especially among females of the higher classes, where not infrequently the general traits approach very nearly to European form and color. Indeed, it has been suggested, and is not improbable, that in the 200 years which elapsed after Magellan crossed the Pacific and before the rediscovery of these islands, that they had been the resort of many Spanish adventurers from the mainland of America, who had intermarried, lived, and died there, and consequently that there was a very marked intermingling of European blood with the native races.

Population.—The population of the Leeward Group of the Society Islands in 1905 was 4,600.

The Windward Group consists of the islands Maitea, Tahiti, Eimeo or Murea, Tetiaroa, and Tubuai Manu.

The Leeward Group of Raiatea, Huaheine, Tahaa, Bora Bora, Maupiti, and the islets Motu-Iti or Tubai, Mopeha, Fenua Ura, and Bellingshausen.

All these islands, except Tetiaroa and the islets of the west, consist of high volcanic mountains, surrounded by coral barrier reefs, the exceptions being of coral formation only.

Climate.—The climate of the Society Islands is hot and damp at all seasons, but on account of the latitude being well to the southward the difference of temperature between summer and winter is very perceptible, especially at night. The climate suits Europeans very well, and they do not suffer from the maladies common to the northern races in hot countries. Sunstroke is not more frequent than in Europe.

The maximum temperature by day rarely exceeds 94° F. during the hot season, in January, and seldom falls below 82° in June; the average is about 86°. The minimum temperature at night falls but little below 81° in the hot season, but in the cool season it often falls to 70° and sometimes to 63°.

Winds.—By their latitude the Society Islands are within the limits of the southeast trades, and at all times of the year the wind has a tendency to blow from the eastward, often remaining for long periods between east and southeast or east and northeast.

Various causes, however, disturb the regularity of the easterly winds, the principal apparently being the vicinity of the Tuamotu Archipelago. When, however, the trade is strong and well established, it blows across these atolls and continues its course to the Society Islands; some violent squalls, peculiar to the Tuamotus, being the only evidence of the struggle. If the trade wind happens to be light in the region eastward of the Tuamotus, it appears to be stopped altogether by these islands; the calm which results tends to increase the temperature of the lagoons and the consequent upward movement of the air, and cold masses of air from southern regions naturally tend to fill up the vacuum.

Thus, at Tahiti, after a day or two of calm, the breeze springs up from the southwest, carrying masses of cold air toward the Tuamotus. This cold air penetrating into the hot and moist tropical regions induces an abundant condensation, a rainy season, and squalls.

During May, June, July, and August the sun is well to the northward, and its action toward heating the water of the lagoons is so much the less powerful, since the general temperature is at its minimum; at the same time the southeast trade is at its full strength, blowing almost without interruption, and the Tuamotus do not cause it to vary more than between southeast and east-northeast. When from the southeast it is strong and squally, becoming lighter as it shifts to east or east-northeast, and returning to the southeast after an interval of calm.

These periods last from one to two weeks, separated by a day or two of calm, and it is seldom that the wind blows from the westward during this season; but in every such case a westerly wind is sure to be weak and of short duration.

As the sun moves to the southward again, its effect in heating the Tuamotus increases, the trade loses its strength, shifting to east-northeast and sometimes to northeast. Then, westward of the Tuamotus, the shifting of the wind is more marked, the periods of the trade of shorter duration, calms more persistent, and winds from the westward more frequent and stronger; and at last, during the months of December, January, February, March, and April, the southern summer, the trade wind becomes very weak. The heat being then at its height over the Tuamotus, the evaporation of the lagoons attains its greatest intensity, so that during this season the Society Islands are nearly always subject to variable winds; and breezes, sometimes fresh from the westward, alternate with calms, storms, and returns of the trade.

Hurricanes.—Between the months of December and March this part of the Pacific Ocean is liable to be traversed by cyclonic storms, which sometimes attain, though rarely, the strength of the cyclones in the China Sea and Indian Ocean. Cyclonic storms passing over the Society Islands appear generally to be moving in a southerly or southeasterly direction.

The cyclone of September, 1877, which ravaged the islands of Anaa and Kaukura, was one of the most violent on record.

In February, 1906, a most destructive hurricane occurred which devastated most of the islands of the Tuamotu Group and caused the loss of many vessels and lives.

The destruction of coconut trees was extensive, and in consequence the export of copra will be considerably diminished for some years, though the discovery lately of large deposits of phosphates in the Society Islands will prevent any great commercial depression.

At Tahiti and Murea Islands the seaboards were devastated by very heavy seas, causing great loss of property, and at Papiete the patent slip and many government buildings were destroyed. The patent slip has since then been reconstructed. At Takaroa Island a large British vessel was wrecked and 10 of the crew drowned.

To an observer at Tahiti the passing of one of these storms, in accordance with the well-known laws, presents the following appearances: Should the center be passing northward of the island, the wind begins from southeast or east and shifts to the northeast like the trade wind, but the falling of the barometer and the threatening and squally appearance of the weather foretell the nature of the coming storm. The wind freshens as it shifts to the north and northwest, and drops as it becomes more westerly and the storm field recedes to the westward.

The sea in this case is very heavy on the northern side of the island, and especially in the pass at Papiete. In this roadstead the wind comes down the mountains in violent squalls, with intervals of calms accompanied by torrents of rain.

Should the center be passing southward of the island, the wind commences at southwest, increasing in strength as it shifts to the westward, begins to drop at northwest, and dies away between northwest and north. The sea is also very heavy on the southern side of the island.

These cyclones as they pass westward, either northward or southward of Tahiti, give place to thunderstorms and heavy rains all over the island, but especially at Papiete. From this is derived the name of rainy season given to the summer months when they are most frequent. They may, however, occur with greater or less violence all the year around.

In ordinary weather there is generally much more swell on the southern and southwestern coasts of these islands than on the eastern coast, though that is exposed to the most common wind, but on the northwestern side there is generally the least sea. From these facts the mariner can form a very fair estimate, where there are many passes through a barrier reef, as to which is likely to have the least sea.

Standard time in the Society Islands.—A standard time corresponding to the mean time of 150° W., or 10 hours slow on Greenwich mean time, has been adopted by the French Government for the Society Islands, the Marquesas, and the Tuamotu or Paumotu Archipelago.

Currents.—The current among the Society Islands is not very regular; but, on clearing the coast, one can generally count upon finding the current setting with the prevailing wind, and at a rate varying from 12 to 20 miles a day, according to the strength of the breeze. Easterly winds being the most frequent, the general set of the current is westward.

Tides.—At Papiete high water takes place every day between noon and 2 p. m. This appears to be peculiar to this locality and is caused by the water thrown over the barrier reef by the sea breeze. Everywhere else among the Society Islands it is high water, full and change, at noon; springs rise 1¼ feet.

Buoyage.—The French uniform system prevails among the Society Islands.

Maitea (lat. 17° 53′ S., long. 148° 05′ W.), the easternmost of the Society Group, also called Mehetia Island, is 1,427 feet high, about 7 miles in diameter, and lies about 60 miles eastward of the eastern extreme of the Taiarapu Peninsula of Tahiti. From its great height it may be seen 60 miles distant in clear weather.

The northern side is remarkably steep; on the southern side the declivity is more gradual. On the eastern side coconut and other trees abound; and near the eastern extreme are two remarkable rocks, and a reef with no pass through it extends eastward from them about 1½ miles. Breakers are reported to have been seen 1 mile from the southwestern extreme.

The only safe landing place is on the southeastern side opposite the native huts, at the end of a pathway leading to the village; even here great caution should be observed, as there are numerous rocks, and it is better to get native assistance before attempting it.

Supplies.—Pigs, fowls, and fruit may be obtained.

Tahiti (lat. 17° 40′ S., long. 149° 30′ W.).—This, the most important island of the group (formerly called Otaheite), is 33 miles in length northwest and southeast and is formed by two ranges of high mountainous land connected by the low Isthmus of Taravao, about 1¼ miles in width. Of these two peninsulas the larger is named Tahiti, the southeastern and smaller Taiarapu. Both peninsulas are included in the general name of Tahiti when speaking of the island as a whole.

Aspect.—From a low and generally very narrow margin of sea coast the land rises to great heights at both extremes of the island, and some highly fertile valleys intersect the ranges in different parts.

The highest mountain in Tahiti, named Orohena, is 7,321 feet in height, and several others vary from 3,000 to 6,000 feet. From them ridges diverge to all parts of the coast. The highest mountain in Taiarapu, Mount Roniu, attains a height of 4,341 feet. An excellent road, known as Broom Road, extends all around the island.

The mountains are frequently enveloped in clouds, so that caution is necessary when making the land at night; and if coming from north or east the light on Venus Point should be sighted before closing with the coast. In clear weather from the great height of the land Tahiti may be seen from 80 to 90 miles distant.

Barrier reef.—A barrier coral reef with numerous passes encircles the island at a distance of from 1 to 2 miles. Within it are several good harbors, the principal being Papiete, on the northwestern side of the island.

Products.—All the productions of tropical countries grow well in the soil of Tahiti and with but little cultivation. It produces cotton of good quality, coconuts from which copra is made, sugar, coffee, and vanilla. The breadfruit and a species of banana are the staple food of the natives. Orange and guava trees form forests. The mango, recently imported, the banana, and all the fruits and vegetables of the Tropics flourish in abundance, and for several years some European vegetables have been grown as well.

Horses of a small but excellent breed are numerous and cheap; cattle are few in number; sheep and goats are numerous; pigs and poultry in great abundance; indeed, many of these latter, as well as dogs, are found in a wild state in the mountains.

The only hurtful animals in the island are centipedes and scorpions, the sting of which, if neglected, provokes a dangerous swelling and causes fever. This may be almost entirely prevented by at once rubbing the wounded part with ammonia or even simply with the juice of the citron.

Communication.—There is a 28-day service between Wellington and San Francisco and Tahiti via the Cook Islands, with punctuality. An intermediate service is kept up by sailing vessels. A line of sailing schooners maintains a service between Tahiti and San Francisco.

The Cie Navale de l'Oceanie have established a steamer for the interisland trade, specially designed for these waters and to carry passengers.

Trade, etc.—The principal exports are copra, mother-of-pearl shell, vanilla, coconuts, etc. The imports are woolen and cotton manufactured articles, groceries, ironmongery and hardware, wines, spirits, etc.

Currency.—With the inauguration of a branch of the Bank of Indo-China, a chartered institution, one of the privileges of which is the monopoly of issuing paper currency, it was natural to foresee the disappearance of the Chilean coinage which had been tolerated in former years. The local government have legislated against the importation of any Chilean coinage into the colony.

Population.—In 1905 there were 11,000 inhabitants in Tahiti and in Murea 1,550.

Local winds.—The trade wind proper blows from southeast between May and August, between September and December the wind is more frequently from east, and from January to April between north-northeast and north-northwest.

Along the coast of Tahiti the winds are modified by the high mountains of the island and by the action of land and sea breezes, the prevailing winds being from east-southeast to east-northeast.

If the wind is from east-southeast, it divides on striking Taiarapu Peninsula, the southern portion blows along the southern coast of Tahiti as far as Maraa Point, when it turns from the coast and blows toward the southern point of Murea. The northern portion blows along the northern coast as far as Venus Point, where it is an easterly wind. There it leaves the Tahitian coast and blows toward the northern point of Murea.

Between Maraa and Venus Points there are generally calms and local breezes which extend for a short distance into the Murea Channel. The dividing line between the winds to seaward and the calm is very clearly marked.

Should the wind be from east or east-northeast it strikes the northeast coast of the Taiarapu Peninsula, and the southwestern coast as far as Teputo becomes becalmed, while a breeze crosses the isthmus of Taravao and blows from the eastward along the southern coast of Tahiti as far as Maraa Point, when it turns away from the coast and leaves a calm between Maraa and Faa Points.

In proportion as the wind shifts to east and east-northeast the line of demarcation on the northern side between the breeze and calm, which begins at Venus Point, approaches the land again and blows along the coast as far as Fareute Point, from whence it turns toward the point of the reef off Faa, leaving the roadstead at Papiete in calm.

Land and sea breezes.—At Papiete land and sea breezes usually prevail, the former commencing about 8 p. m. and lasting all night until 7 a. m.; the sea breeze generally sets in about 9 a. m. and blowing from northwest dies away about 5 p. m.

Currents.—Along the north coast of Tahiti the general set of the current is to the northwestward, and on the south coast to the southeastward. With westerly winds the current is often reversed; in fine weather the rate of the current is about 1 knot an hour, but with strong winds it sometimes attains a rate of 3 knots.

Venus Point (lat. 17° 29′ S., long. 149° 29′ W.), the northern point of Tahiti, has probably had more extensive series of observations made on it than any other place in the Pacific. The transit of Venus was observed here in 1769, the longitude deduced from Cook's observations being 149° 26′ 15″ W.; from observations made during his second voyage it was found to be 149° 28′ 23″ W., nearly identical with that made in 1826. The position as now settled is latitude 17° 29′ 14″ S., longitude 149° 29′ W.

Aspect.—It is a long low point extending to the northward about 1 mile from the foot of the mountains, forming a plain completely wooded with coconuts, and intersected by a river which runs through the Tuauru Valley.

The lighthouse stands only about 60 yards within the edge of the beach, and a church stands about 660 yards 163° from the lighthouse; its steeple shows above the trees and can be seen from all directions. Between the church and the lighthouse is a tamarind tree planted by Cook on his first voyage, and indicating the spot at which he observed the transit of Venus in 1769. A stone, reported to have been placed in the ground by Capt. Cook, lies about 100 yards west of the lighthouse; it is 15 inches square, and has a meridian line cut across it.

Over Capt. Cook's bench mark is a stone column, supporting a sphere, and resting on a broad plinth, surrounded by an iron railing; it was erected in 1901.

Reef.—A reef awash extends in an arc northward, eastward, and westward of the point, about 600 yards from the beach, and there are probably shoal heads a short distance seaward of the line of breakers. On the eastern portion of this reef, 650 yards 77° from the lighthouse, is a small islet.

Boat passage.—There is a boat passage alongshore between the reef and the beach.

Light.—The lighthouse on Venus Point is a circular white tower; from it is shown, at 82 feet above the sea, a fixed white light, visible 15 miles.

Matavai Bay, on the western side of Venus Point, between it and Utuhaihai Point, and inclosed to seaward by shoals and banks, is exposed to the swell from seaward, and when it sets in, landing in ships' boats becomes dangerous. It affords good shelter with winds from southwest through south and east to north-northeast, but is dangerous with winds between northwest and west, as a heavy sea then sets in. At all seasons vessels should be prepared to leave if the wind shifts to the northward of northeast.

Dolphin Bank.—Separated from Venus Point Reef by a 12-fathom channel about 150 yards wide, is the Dolphin Bank with a least depth of 13 feet, about 1,050 yards about west by south of the lighthouse.

A channel about 200 yards wide separate the Dolphin Bank from the Toa-Mapa and Toa-Tehe Reefs, a chain of shoals extending to the southwestward for about 1¼ miles. There are several channels through these reefs, and the depth is very irregular; on some of the coral heads there are only from 15 to 20 feet water.

The shore of Matavai Bay consists of a slightly receding sandy beach, with many houses, streching for about 1 mile southwestward toward and terminating in the rocky hill called Mount Tahara, with a cliff face toward the sea; from thence onward to Utuhaihai Point, 1¼ miles, the coast consists of a series of small sandy bays separated by rocky points surrounded by coral reefs.

Between Toa-Tehe and Toa-Mapa Reefs and the shore a little westward of Mount Tahara, are Mahoti Reefs, on which are depths of 2 fathoms, and a small patch of only 5 feet on its western side.

With a heavy swell from seaward there are breakers on the Dolphin Bank, Mahoti Reefs, and some parts of Toa-Tehe and Toa-Mapa Reefs.

Directions—Anchorage.—When making for the anchorage with easterly winds, a sailing vessel should pass close to the reef off Venus Point, but keeping clear of the depth of 2 fathoms extending for a short distance westward of the breakers. These shoals will be cleared by steering 194° for the perpendicular cliff at the western extreme of Mount Tahara. When the lighthouse bearing 94° is in line with the northern point of Motu Au, a small wooded island to the eastward, luff up quickly to avoid the Dolphin Bank, and shortly afterwards, as soon as the point of the breakers has been passed, steer about 133°, and anchor when the church bears 90°.

This maneuver, which is easy when the wind is east by north, is more difficult with an east by south wind, because it is necessary to pass as close as possible to the reef off Venus Point, and at the time for luffing to enter the channel, to expect a current setting along the reef toward the Dolphin bank.

It is also possible to enter by the channel southward of this shoal, and by luffing to come to an anchor in 8¾ fathoms, or else to tack inside the bay in order to reach the anchorage before mentioned.

Anchorage.—In Matavai Bay anchorage may be obtained anywhere in from 8 to 16 fathoms, sand. The best is about 600 yards from the beach in 11 fathoms, with the church near Venus Point bearing 90°.

Northwest coast.—Utuhaihai Point is low and covered with coconut and ironwood trees. The tomb of the Pomarés is situated here by the side of a church, a large white building visible from seaward. From Utuhaihai Point to Fareute Point, about 3 miles westward, the coast is low, the foot of the mountains receding some little distance inland, leaving between them and the sea a belt of well wooded and cultivated land, well watered by streams, and with many houses.

Papawa Harbor.—From off Utuhaihai Point a reef awash, from 750 to 900 yards from the shore, extends to Taunoa Pass, a distance of 1½ miles. Inside, and protected by the reef described, is a basin obstructed by banks of coral, with winding deep-water channels between them, having from 8 to 11 fathoms, sand, from 200 to 300 yards wide, with a pass about 100 yards wide opening into it from Matavai Bay opposite Utuhaihai Point; and another, very narrow, intricate, and with less than 3 fathoms water at its western entrance. This basin bears the name of Papawa Harbor.

Anchorage.—The anchorage is northwestward of the King's house, a large European building, with a veranda, close to the beach, at about 600 yards southwest by west of Utuhaihai Point.

Taunoa Harbor.—This harbor is separated from Papawa Harbor by Arahiri Point.

TAUNOA PASS—BEACON.—Taunoa Pass is about 300 yards wide, with no dangerous bar, and clearly marked by the edges of the reef awash on either side. On the eastern side, however, rocks with only 9 feet, on which the sea sometimes breaks, extend about 150 yards northwestward of the point of the reef awash. Another rock inside the pass near the western side, about 100 yards 166° from the eastern point of the western reef, is marked by a red beacon with conical topmark. Taunoa Pass may be recognized from a long distance seaward, when in the right direction for entering by a remarkable rugged peak, named the Diademe, which when seen through a deep gorge bearing 149° leads up to the entrance. This pass is one of the best in Tahiti, and the breeze is more regular than at Papiete. Sailing vessels going to Papiete often enter by Taunoa Pass and use the narrow but well beaconed channel inside the reefs which connects Taunoa and Papiete.

The current nearly always runs out through the pass, but is not very strong.

Leading beacons.—Two white pyramidal beacons stand on the shore close to the beach; the front beacon is of open woodwork, the rear beacon of solid masonry; kept in line on a 149° bearing they lead through the middle of the pass.

Anchorage.—The best anchorage in Taunoa Harbor is with the two beacons in line, and Arahiri Point bearing 79°. Small vessels can anchor nearer the eastern reef, where the water is smoother. The bottom is of black sand.

The anchorage in Taunoa harbor is good with easterly winds, but as the pass is wide, the swell rolls in heavily upon the sandy beach at the head of the bay. With strong northwest winds it is a dangerous anchorage, and landing impossible from boats, even by entering the channels through the reefs on the one side or the other. It is rarely used except by vessels about to proceed through the channel leading to Papiete.

Taunoa Channel connects Taunoa with Papiete Harbor. It is well beaconed, having black beacons on the southern side, and red beacons on the northern side. It is very tortuous, about 1½ miles in length, and not to be used by a stranger without a pilot. With an easterly wind, vessels drawing as much as 19 feet can use it with safety, but long vessels experience some difficulty in making the sharp turns at the eastern end of the channel, where two banks of coral divide it into three narrow passages with depths of 6½ fathoms. A black beacon marks the northern point of the northern patch, and a red beacon the southern point of the southern patch; an anchor is placed between the two beacons above water to permit of making fast a hawser.

Papiete Harbor (lat. 17° 32′ S., long. 149° 34′ W.) is the most important and affords the best shelter of any harbor in the island of Tahiti; it is inclosed between the shore and the barrier reef, through which there is a narrow passage. The northern half has several coral reefs, but the southern part is clear of dangers beyond the reefs fringing the shore. It affords anchorage in from 10 to 15 fathoms over a space about a mile in length and ½ mile in breadth, over a bottom of sand and mud.

It is in many respects a convenient harbor, but is subject to calms and much hot weather in consequence of its leeward position, the free course of the trade wind being diverted by high lands and obstructed by groves of coconut and other trees.

Landmark.—The white cupola of the astronomical and meteorological observatory, erected 200 yards southward of the semaphore station, is conspicuous when seen from seaward.

Town—Quays.—Papiete is the seat of government of the Society Islands, and the town extends from Fareute Point for about 1 mile westward along the beach. There are several quays which admit of vessels of large size going alongside, and mooring buoys to assist them in doing so.

The length of wharfage, having a depth of 16 to 21 feet alongside, is 605 feet for steamers and 1,962 feet for sailing vessels. The depth increases very rapidly a short distance away, and a steamer of 8,000 tons, drawing 24½ feet, has been loaded at a distance of 10 feet from the wharf.

A scheme of improvements has been drawn up for constructing a wharf at the east end of the harbor 650 feet long, with a depth alongside of 31 feet. A coaling depot is to be made at the end of the new wharf.

Radio station.—At the site of the old arsenal near Fareute Point two black wooden columns, square in section, surmounted by iron masts, have been erected. These columns are the towers of a radio station in course of construction, and constitute conspicuous marks from seaward.

Aspect.—On approaching from seaward one of the first objects in the town which comes into view is the white steeple of the cathedral, which stands about 1,000 yards 149° from Fareute Point, and overlooks the trees by which most of the other buildings are hidden.

Immediately over the town is a bare hill, named Mount Faiere, which terminates in a plateau 236 feet above the sea. At 300 yards 31° of the plateau is a semaphore and signal station with flagstaff.

A new church, painted light yellow, with a red spire, has been erected in a position adjoining the British consulate. When seen from seaward this is even a more conspicuous object than the spire of the cathedral.

Papiete Pass—Depths.—The entrance into Papiete Harbor is a break about 550 yards wide in the barrier reef, but the bar channel is so narrowed by shallow water extending from the reefs, and especially from that on the western side that, although improved by dredging and blasting, the navigable breadth with depths of 4¼ fathoms is 126 yards wide, and that with a depth of 6 fathoms is about 60 yards wide. Further widening of the channel to 158 yards is intended. The sea nearly always breaks on the shoals bordering the fairway.

Harbor—Anchorage.—Within the pass the harbor opens out to a spacious anchorage.

The pass is available for vessels under 20 feet draft during the southeast trade season, but in the summer months, November to April, the rainy season, when the trade wind is well to the northward and interrupted by calms and variables, there is considerable sea at times at full and change of the moon, and it is not recommended for vessels above 16 to 18 feet draft, unless the state of the bar has been carefully observed before entering.

Caution.—The chief danger to sailing vessels using the pass at Papiete, is that the wind may fail them suddenly, and the current, which is nearly always running out, may set them on the reef. Sailing vessels from a distance should always take a pilot to enter the harbor, as he will know how the wind is at the anchorage, which is often very different from that outside. The land breeze is more regular and steady than the sea breeze, and should be taken advantage of for leaving the port.

Currents in Papiete Pass.—Outside the reef the current generally sets to the westward about 1 knot an hour, which should be borne in mind when about to enter.

Tidal streams are but little felt in Papiete Harbor. The currents which prevail in the pass being due chiefly to the state of the sea upon the neighboring reefs. The volumes of water thrown by the waves over the reef off Faa cause a current which runs out toward the pass to the northeastward and north; while the current from the water driven in over Taunoa Reef runs toward the pass in a west by south direction along the inside edge of the barrier reef; so that the resulting current through the pass depends on the proponderance of the one or the other of the two currents which form it.

When the sea is heavy to the southward of the harbor and slight upon the northern reef, the current from Faa is the stronger and the current through the pass is more northerly; this generally is the case in the fine or winter season (May to October). But when the swell comes from the north and breaks heavily upon Taunoa Reef, the westerly current prevails and the current through the pass is more westerly. Under these latter circumstances, the pass of Papiete becomes very dangerous, as the sea is heavy, and the current, sometimes attaining a rate of 4 or 5 knots, sets right upon the bar. It has been reported that at full and change in the summer (rainy season), a heavy swell sets in from the northwest without any apparent cause, rendering the pass a mass of breakers.

Leading marks.—Two white obelisks, about 40 feet high, for leading through the entrance, are in line on a 175° bearing, and are placed, one on the eastern edge of Soaotoi Reef, which reef is separated from the inner part of the barrier reef on the western side by a narrow but deep channel.

Two white triangular beacons have been established as daymarks in place of the leading lights, the front beacon on the prison wall at a distance of about 100 yards inside the entrance of Tipaerui River, and the rear beacon about 150 yards 149° from the front beacon.

These two beacons, when in line 149°, lead through Papiete Pass.

Lights.—On the quay northward of Manutention are two small red leading lights 98 feet apart, bearing from each other 95°. They are difficult to distinguish from the other lights on the quay. In line they lead southward of the reefs off Motu uta Island.

Directions.—Papiete Harbor presents no difficulty of entry or exit for a steamer of light or moderate draft, and may be used, except in gales from the northwestward. For sailing vessels great caution is necessary, as already remarked, especially in light winds, and a pilot should always be employed.

By night sailing vessels should never attempt to enter, as they are almost sure to find the land breeze in the pass.

For entering, bring the two obelisks in line 175° and steer in on that bearing with the vessel well under command until the two beacons come in line; then haul up and run in one the latter line 149° and steer for anchorage, which, avoiding the various shoals, may be found in all parts of the harbor in from 8 to 18 fathoms to within 100 yards of the shore. If intending to remain some time, it is best to moor, as the constant shifts of wind are almost certain to cause a foul anchor.

Motu Uta is a little sandy island planted with coconut trees, and lying 600 yards 245° of Fareute Point between the shore and the barrier reef. It stands on a coral reef awash, separated from the neighboring reefs by deep channels.

Three other reefs awash, separated by deep channels, lie southwestward of Motu uta, extending in a line in a 122° direction from the pass. The western reef is marked by a gun on the western edge. The other two reefs are each marked by a gun on their southern ends.

Beacon.—The eastern extreme of the reef surrounding this island is marked by a black stake, 4 feet in height.

Rock.—Five hundred yards 144° of the pass is a rock, with a depth of 5½ fathoms over it.

Weather.—Rain squalls seen in the direction of Venus Point and a little to the southward of it, usually reach the anchorage; but those collecting over Aorai Peak and the other heights seldom descend to the harbor.

Hospital.—A lazaretto has been built on Motu uta, and a pier constructed on the southwestern side. Seamen are admitted to the military hospital on payment of a fee.

Quarantine.—Vessels entering the port of Papiete at night, are required to anchor at the quarantine ground and wait for daylight to obtain pratique.

Repairs.—There is no drydock nor any convenient place to lay a vessel aground, the bottom being coral, and the tidal range only 1 foot.

The patent slip will take a vessel of 400 tons, and has taken one of 600 tons; the cradle is 164 feet long, the slip 450 feet, and the width of cradle 20 feet with extension to 30 feet. Draft, 6 feet forward and 15 feet aft.

Schooners of 65 tons have been built here by private firms, and shears erected to lift 20 tons.

Supplies.—Live stock from New Zealand and all sorts of cold-storage meats, are obtainable from the Tahiti Sugar & Commercial Co. Vegetables are scarce.

Water may be procured from a tank or brought off from alongside the quay in bulk from the hydrants, either at the arsenal wharf or the Government wharf opposite the French flagstaff.

Coal.—The Government has a coal depot of about 2,000 tons; and a supply can generally be obtained from the Société Commerciale, or from one or two other private firms, but the quantity in stock is irregular and uncertain; it is chiefly French and Australian coal. Vessels drawing 22 feet can coal alongside the wharves. There are three small lighters belonging to the Government. No liquid fuel is kept in stock.

A coal hulk is moored at 300 yards north-northwestward of the customhouse.

Northwest coast.—From Papiete Pass the barrier reef trends for about 3 miles to the westward, at from 1,200 yards to 1 mile from the shore, then it turns sharply to the southward for 3 miles to Taapuna Pass.

From Papiete to Taapuna Valley the foot of the mountains is close to the sea, with here and there a narrow wooded plain between it and the beach. This coast curves slightly as far as Faa village, opposite which is the large wooded islet, Motu Tehiri, and then trends at right angles southward 5½ miles to Punaavia Point.

Faa Channel.—Between the barrier reef and the coast there is a channel about 5 miles long and frem 100 to 650 yards wide, with depths of from 6½ to 13½ fathoms, connecting Papiete Harbor with Taapuna Pass. This channel is accessible to large vessels; it has, however, several midchannel shoals, all of them plainly visible from the masthead.

The water thrown in by the surf breaking over the barrier reef collects in this channel and escapes on the one side by Papiete Pass and on the other by Taapuna Pass.

Taapuna Pass (Lat. 17° 35′ S., long. 149° 37′ W.) is dangerous and is not recommended. Its direction is about east and west, and it is more than 100 yards wide between the reefs awash, but is encumbered by shoals, of which one has only 7 feet water. Between these shoals there is only a narrow and winding channel of deep water.

Beacons.—Nine conical beacons, painted red, and eight cylindrical beacons, painted black, have been placed on the reefs, on either side of this pass.

The current always sets out strongly, especially when the sea is heavy upon the reef; at such times the surf breaks upon the shoals in the pass, which then becomes a mass of breakers.

Directions.—Small vessels or boats when bound to any place between Papiete and Taapuna, if circumstances permit, should enter by the Papiete Pass, and no sailing vessel should attempt to enter by the Taapuna Pass unless assured of a strong, fair wind to enable her to stem the current. If compelled to enter the Taapuna, however, she should keep in midchannel in the outer part of the entrance, steering 76°, then edge away to port and keep close to the reef on the northern side and keep in the channel as marked by the beacons.

When going out, it is easiest and most direct to keep very close to the reef on the northern side, steering about 279°, but this leads over some patches of 13 feet, on which even a small vessel might touch with any swell on. To follow the winding passage, where there is more water, it is necessary to steer from aloft.

West coast.—From Taapuna Valley the narrow plain between the foot of the mountains and the coast becomes broader and is sometimes ½ mile wide. At 1½ miles south of Taapuna Pass is the Punaruu Valley, an immense gorge cutting the mountains from top to bottom and penetrating to the middle of the island, where it opens out into a vast amphitheater hemmed in by the peaks Orohena, Aorai, and Diademe, which are visible to seaward when opposite the gorge.

The Punaruu River runs through this valley, and its deposits have formed Punaavia Point and the bottom of the bay of that name.

On the lower slopes on the left bank of the Punaruu are several blockhouses, constructed when the French took possession of the island. Another blockhouse is on the shore at Punaavia Point, and an iron bridge crosses the river about ½ mile inland. From Taapuna Pass the barrier reef approaches the coast and joins the beach 1,200 yards northward of Punaavia Point. Between Taapuna and this point there is a passage for boats between the reef and the shore. A narrow gap named Taipari Pass allows the escape of all water accumulated by the surf breaking over the reef.

Punaavia Bay, about 1½ miles southward of Taapuna Pass, where the barrier reef ceases and forms a small bight, is about 1,200 yards long. Here anchorage may be obtained in depths up to 27 or 33 fathoms, sand and mud. It is, however, perfectly open, and the heavy southwest swell rolling in on the gravel and sandy beach at the head of the bay nearly always renders landing both difficult and dangerous. The best anchorage is ½ mile from Punaavia Point, in from 8 to 11 fathoms, sand and mud, with the blockhouse on the point bearing 177°.

Shoals.—In the northern part of the bay, opposite the end of the barrier reef, there is a coral reef 1,000 yards offshore and about 600 yards long, north and south, on which are depths varying from 6½ to 13 fathoms. At 500 yards 335° from Punaavia Point is the Phaeton Shoal of 16 feet.

The winds which blow along the land do not generally reach the anchorage, and ships intending to leave under sail have usually to wait for the land breeze.

The current always sets from Punaavia Point to the northward and northwestward, being caused by the flow of water accumulated inside the reef extending from that point to the southward.

The reef extends about 1,000 yards from the land, and the channel lies close around Punaavia Point, allowing boats to pass inside the reef as far as the village of Paea, 4 miles to the southward, where there is a break in the reef of about 200 yards.

Paea.—This part of the coast is easily recognized, and Orofere Valley, behind the village, is the only one which appears to penetrate into the middle of the island after leaving Punaavia. Near the shore the chief house in Paea may be distinguished behind a row of fine ironwood trees.

On both sides of the gap opposite Paea are boat passages through the reef; they are always dangerous and become impracticable when the sea is heavy. The northern pass is the best, the southern pass being a mere rapid where the current rushes out with great velocity.

Only very small vessels ought to anchor in the gap in the reef, and then only in case of absolute necessity, as it is a dangerous place.

West coast.—From Paea the reef trends without a break for 3½ miles to Maraa Point, at about 1,000 yards from the land, and rounds the point at about 1,200 yards, where it is not so steep-to as usual, so that it would be prudent not to approach the breakers too closely.

Maraa Point is low, wooded, and, projecting 200 or 300 yards from the foot of the mountains, may be easily recognized from seaward by the sudden turn in the direction of the coast from the southward to the eastward.

From a distance the mountains appear to form a gentle declivity which falls suddenly toward the sea by a steep slope of from 300 to 600 feet in height.

Maraa Pass.—In the middle of the rounded part of the reef, southward of Maraa Point, is a pass about 200 yards wide, open to the southwest by south. At the entrance the points of the reef on each side extend nearly 200 yards seaward of the breakers.

Directions.—There are two white triangular beacons, one on the beach and one on a coral patch at the inner end of this channel. To enter, keep these beacons in line bearing 26° until nearly abreast a red beacon on the east reef, then alter course to starboard and pass the black buoy, marking a 2-fathom shoal, on the port hand, from whence a 335° course will lead to the anchorage.

The current in the pass nearly always runs to the westward, but a series of westerly winds will turn it to the opposite direction; its strength depends on the state of the sea on the neighboring reefs, and sometimes in the winter season, when heavy swells from the southwest are common, it attains a rate of from 4 to 5 knots; on meeting the sea, it then breaks right across, and entering becomes impracticable. The tidal movement also influences the current, as it decreases in strength during the flood, i. e., in the morning, and increases with the ebb.

Anchorage.—Opposite and within the pass, near a little watercourse, anchorage may be obtained in 11 fathoms, sand, with Maraa Point bearing 281° about 500 yards.

The barrier reef—Channels.—From Maraa Pass the barrier reef extends eastward for 3½ miles, about 1,600 yards from the shore, and inside it are a series of large basins strewn with coral patches, with deep water between, where anchorage may be obtained almost anywhere.

Beacons.—**The inner channel** here is marked by beacons with colors and top marks applicable for navigating from west to east, from Maraa as far as West Ava-iti. Besides Maraa Pass there are two other channels through the reef, Topiro Pass, 1¼ miles eastward of Maraa Pass, and West Ava-iti Pass, 2 miles farther east; they are small, deep, and only practicable for boats in calm weather; when the sea is heavy they are very dangerous.

At Terehe, about 1 mile eastward of West Ava-iti Pass, there is a boat passage in the reef opposite the house of the chief and of the church of Papara, both of which are visible from seaward; the current runs out strongly and the passage is only practicable when the swell is not very heavy.

South coast.—From Maraa Point the coast trends eastward 5¼ miles to Popote Bay; the appearance of the country changes, the climate becomes moister than the part between Venus Point and Maraa Point, the trees descend to the foot of the mountains, and in the plain the orange and citron flourish abundantly.

From Papara the foot of the mountains recedes from the coast, leaving a plain about ½ mile broad and 5 miles long.

Popote Bay.—This bay is formed by a break in the reef about ½ mile wide, and by some banks extending 500 yards seaward from the eastern reef, inclosing a harbor in which the depth does not exceed 11 fathoms, sand and gravel; it is too much exposed to the southwesterly swell to be a safe anchorage, but is convenient with easterly winds.

Taharuu River, one of the largest in Tahiti, flows into this bay from a deep gorge penetrating to the middle of the island.

The barrier reef.—The barrier reef recommences at Mahaiatea Point, which point forms the eastern side of Popote Bay, and is one of the highest of the generally low points on the southern side of the island. The reef, extending about 1 mile from the land, forms a curve for more than 3 miles eastward to Aifa Pass and incloses the large basin of Atimaouo, with depths of from 8 to 16 fathoms, which, although strewn with coral patches offers numerous anchorages which, during the prosperous times of cotton cultivation in this neighborhood, were much frequented. These inner channels and passages are beaconed according to the French system, and for entering from seaward by the Aifa Pass.

Teavaraa Pass is at the western end of the Atimaouo Basin, about 1 mile southeastward of Popote Bay; it is wide but has only 13 feet water on it. Directly exposed to the swell from the southwestward, it is more of a bar than a pass, and the sea almost always breaks across it. Small vessels may possibly use it when easterly winds prevent their getting out of Aifa Pass, as they can make sure that the bar is practicable before getting under way, but they should never attempt to enter by it under any circumstances.

Aifa Pass.—This pass is formed by a break 400 yards wide in the barrier reef, obstructed on the western side by a bar extending about 400 yards seaward, leaving an oblique channel about 100 yards wide between it and the point of the eastern reef, which latter point is steep-to and clean. This pass is often dangerous, and with the heavy swell from the southward, so commonly experienced, the current running out against the sea causes heavy breakers right across the entrance, when it would be the height of rashness to attempt entering.

Directions.—To enter Aifa Pass in a sailing vessel make sure that the sea is not in the dangerous state just described, and that there is a fresh breeze inside the reefs. Steer about 329°, passing close to the point of the reef on the eastern side, and then haul up to 341°. Four coral patches will then be left on the port hand, with a small sandy islet on the most northern. Then pass between two small patches, awash, each marked by a red buoy, 300 yards apart, lying just westward of the south point of Mapeti Island, which is near the northwestern end of the eastern reef. Then, keeping a little to port, leave a coral patch, whose northern point is marked by a black beacon, on the port hand. Another coral patch lies 300 yards southwestward of the above patch and is also marked by a black beacon.

Anchorage may be obtained between the two black beacons and the land in from 11 to 16 fathoms, sand, close to the house of the chief of Mataiea, situated on the banks of a river.

When going to sea pass close to the point of the eastern reef.

Rautirare Pass (lat. 17° 46′ S., long. 149° 22′ W.), about 1¼ miles eastward of Aifa Pass is the best pass in Tahiti; it is 400 yards wide, open to the southward, perfectly clear, very deep, and practicable at all times. On the eastern side of the channel near the northwestern corner of the reef is Pururu Islet, about 1,000 yards inside the outer line of breakers.

Papeuriri Bay.—The pass opens in Papeuriri Bay, which extends about 850 yards each way. It is perfectly clear, and the depth varies from 8 to 13 fathoms. black sand; lesser depths of 5 fathoms extend at most to 150 yards from the shore. The coast is lined with sandy beach, and the Vairaharaha River discharges into the bay opposite the pass.

Anchorage, generally safe, may be obtained anywhere in the bay, and especially near Pururu Islet. The pass is, however, so wide that a vessel would not be sheltered from strong winds and a heavy sea from the southward, but would have to enter one of the channels communicating either with Aifa Pass on the west or with Temarauri Pass on the east.

Ototara Channel, which connects the anchorage opposite Aifa Pass with Papeuriri Bay, is a narrow inner beaconed channel about 1,650 yards long and 50 yards wide in the narrowest part, having a depth of from 8 to 11 fathoms. with the exception of two shoal patches on which there are only 3¾ and 3¼ fathoms.

South coast.—From Otiaroa Point, opposite Pururu Islet, the coast bends to the northward for about ½ mile, and then trends irregularly eastward 3 miles to Oneroa Point, which point faces Hotumatuu Pass. The mountains, wooded to the base, are cut into a series of gorges, parallel with one another, from which several rivers flow.

Temarauri Pass, also called Papeari Pass, is about 1,000 yards westward of Hotumatuu Pass, and gives access to a series of basins extending westward for about 1½ miles and communicating by a narrow channel with Papeuriri Bay. It is 200 yards wide and 600 yards long in a northwesterly direction, but the eastern reef extends southwest by south right in front of the pass and forms a bar which it is generally unwise to cross. The pass thus forms an elbow at its mouth in a north and south direction.

A small reef awash, marked by a red spindle beacon, lies about 550 yards inside the entrance and about 100 yards from the eastern reef, leaving a passage about 150 yards wide between it and the western reef.

Directions.—On entering this pass steer 352°, leaving the point of the western reef about 100 yards on the port hand; after rounding this point, alter course to 312°. looking out for the isolated reef on the starboard hand.

Papeari Harbor (lat. 17° 45′ S., long. 149° 21′ W.).—Temarauri Pass opens out in Papeari Harbor, an anchorage about 1,000 yards long and 800 yards wide, separated by a point projecting from the barrier reef to within 400 yards of the shore from a second basin named Port Ataiti. This point and bank projecting from the barrier reef leave a passage into Port Ataiti only 100 yards wide between them and the land, with nothing less than 5 fathoms.

Rock.—A coral rock, with a depth of 3 fathoms, and 10 fathoms around, is situated at ¼ mile southeastward of Ofaiharata.

Motuoini Channel.—This channel leads from Papeari Harbor to Ataiti. It is used by the vessels of the Union Steamship Co. of 2,000 tons.

The northeastern point of the bank and many of the shoals within are marked by beacons.

Anchorage.—The depths in Papeari Harbor vary between 13 and 19 fathoms, sand or mud. The usual anchorage is in the direction of the pass at from 400 to 550 yards from the land, opposite the mouth of a small rivulet.

Ataiti Harbor, or Basin, is 1½ miles long and from 500 to 1,200 yards wide, and is an open space between the shore and barrier reef, with depths varying between 5 and 8 fathoms, muddy bottom.

Hotumatuu Pass is a break in the barrier reef 300 yards wide. It is more of a cul-de-sac than a pass, as it does not lead into any important basin. Small vessels may, however, find shelter from westerly winds at the head of the pass, in the Port of Paui, where the depth is from 9 to 12 feet only.

South coast.—From Oneroa Point the coast takes a sharp turn and trends northeastward about 2 miles to Taravao Isthmus, two deep bays blocked with coral breaking its general direction. The mountains, wooded from top to bottom, approach the sea and fall abruptly to the isthmus, which is only about 100 feet high.

From the isthmus the coast returns parallel to itself for about 1 mile to Teaua Point, forming Port Phaeton, about 650 yards wide. From Teaua Point the coast trends southeastward 1 mile to Tohautu Point, which direction it preserves to the southeastward.

Aspect.—From the isthmus to Tohautu the coast is low, wooded, and broken by deep bays blocked with coral. At the entrance to one of these, Mitirapa Bay, is a bridge, about midway between Teaua and Tohautu. The land rises in gentle and uniform slopes to the high and rugged mountains in the center and southern part of the Taiarapu Peninsula.

From Tohautu Point the hills approach and almost overlook the sea. The first of these, Farei Hill, has a bare rounded summit overlooking Tohautu, and forming a good mark from seaward by which to make the two white pyramids placed at Tohautu as a leading mark into Teputo Pass.

From Hotumatuu Pass, the barrier reef trends eastward for 1 mile to Teputo Pass, and then turns suddenly southeastward and in that direction along the coast.

Port Phaeton (lat. 17° 44′ S., long. 149° 19′ W.).—**Teputo and Matu Passes.**—Teputo Pass is the most direct entrance to Port Phaeton, but though the outer opening through the reefs is nearly 400 yards in width, for a distance of about 200 yards it is only 130 yards wide, though deep and clear of dangers. This break in the barrier reef is at the angle where it commences to trend away to the southeastward. At 400 yards within the entrance the western reef curves away to the northwestward, and the eastern reef turns sharply eastward. Inside, and in front of the gap, is the Ma tu hu Reef, a large coral reef of irregular form about 1,000 yards long from south to north, and marked at its northern extreme by a tripod beacon. This bank divides the opening into two distinct passes, that of Teputo on the eastern, and of Matu on the western side. The latter is about 400 yards wide, but has a small bank in the middle, leaving a deep channel about 150 yards wide between it and Ma tu hu Reef; it forms a sharp elbow, however, and not being marked by beacons should not be attempted except in case of necessity.

Leading beacons.—Two white pyramids in line 68° form the leading mark for Teputo Pass; the front beacon is placed at the extreme end of Tohautu Point, the rear beacon near the foot of the northern slope of Farei Hill, which hill, as before stated, forms a good guide to their locality when approaching from seaward.

DIRECTIONS.—Directly a vessel is fairly through the pass in entering, the line of the beacons has to be quitted and a 9° course steered through the Tohautu Basin, along the eastern side of the Ma tu hu Reef, at the northern end of which, where stands the tripod beacon before mentioned, the Matu and Teputo Channels reunite.

From the northern end of Ma tu hu Bank the channel up to Port Phaeton is 400 yards wide between the reefs and from 8 to 16 fathoms deep. Halfway between Ma tu hu Reef and Teaua Point, Toamote Reef on the western side is marked by a black beacon on its eastern extreme. There is also a small patch near Teaua, at which point the channel opens into Port Phaeton.

Port Phaeton is more than 1 mile long from Teaua Point to Taravao Isthmus. Near the head of the port is a stone jetty built out to the edge of the reef to facilitate landing; it is connected by a carriage road with Fort Taravao and with the main road of the island. The sides of the harbor are indented by deep bays blocked with coral, but in the middle there is a channel 400 yards wide and quite clear, affording anchorage anywhere in from 5 to 11 fathoms, with excellent holding-ground of mud. Where the coral reefs project into the harbor they are marked by beacons.

Toahutu Basin—Anchorage.—Toahutu Basin, just inside the pass, affords safe anchorage in the western part, and the reefs on the eastern side are marked by beacons; the anchorage is about 1,000 yards long north and south, by 500 yards wide, in from 16 to 22 fathoms, sand and mud. With Toahutu Point bearing 79° and Mitirapa Bridge 23°, there is 270 yards swinging room in all directions.

Caution.—The Teputo Pass is only recommended for sailing vessels, in fine weather. With a heavy southwesterly swell in the narrow part of the pass, there is great risk of a sea striking a ship on the port quarter and forcing her bow around to port and the vessel on to the rocks on the weather side before she can be kept away again. In such weather it is best to enter by the Tapueraha Pass and then to proceed by the inner channel to Port Phaeton.

South coast.—From Teputo Pass the barrier reef trends southeastward about 5 miles to East Ava-iti Pass. At 2½ miles from Teputo Pass is Tapueraha Pass, and the barrier reef between the two, which is about 1,000 yards wide, is named Temaino Reef.

Tapueraha Pass is about 600 yards wide, but the navigable channel is narrowed by a shoal extending southward about 300 yards from Temaino Reef, over which there are only from 9 to 12 feet water, and by a shoal from the southern reef, over which there are about 3 fathoms, leaving a deep channel about 200 yards wide between them. When within these shoals the pass rapidly opens out.

As before remarked, with a westerly swell this pass is much to be preferred to Teputo Pass when bound for Port Phaeton.

Directions.—Off Riri Point the passage is very narrow, a reef lying in mid-channel; the western passage is the straighter and better.

Anchorages.—Inside the pass is a safe harbor about 1,600 yards wide, with anchorage in from 10 to 22 fathoms. The swell enters by the pass and breaks upon the beach. At 550 yards inside the entrance is the Roae Reef, a small patch with 3¾ fathoms; another patch, the Tahire Reef, of only 5 feet, lies about 550 yards southeastward of the entrance.

Between Temaino Reef and the shore is a narrow channel marked with beacons, connecting Tohautu Basin with this harbor; and another channel, 500 yards wide, leads into Port Vairao, the large basin to the southward, in which there is generally muddy bottom with from 8 to 16 fathoms water; there are several reefs marked by beacons, and anchorage may be obtained almost anywhere among them.

Port Vairao.—Telephonic communication with Papiete is maintained, and there is coach communication two or three times a week.

Fresh water can be obtained from Vavii River, but should not be used for drinking purposes.

South coast.—Southward of Port Vairao is a rounded point where the coast turns to the eastward for about 600 yards and then trends southeastward for about 1½ miles to the low Point Arahuku, close to which is the village Teahupu; it then continues in the same direction for 1¼ miles to the low point Fare Mahora, after which it trends eastward for 5 miles to Fareara Point, the southeastern extreme of the Taiarapu Peninsula.

Pehoa Channel.—This channel, which connects Port Vairao with the basin of Teahupu is beaconed and can be used by vessels of 180 feet in length. In proceeding through from the northward it should be borne in mind that the shore reef projects some distance beyond the line joining the second and third black beacons.

Aspect.—The whole of this coast is dominated by high mountains, between which are deep gorges and valleys trending toward the center of the peninsula.

East Ava-iti Pass (lat. 17° 50′ S., long. 149° 17′ W.).—This is a small pass about 130 yards wide and 400 yards long, with from 18 to 16 feet water at the entrance; it is only practicable in very fine weather and for vessels of small tonnage.

The barrier reef.—From East Ava-iti Pass the reef curves eastward for 2½ miles, past Ava-ino Pass, to Havæ Pass, on the eastern side of which it rejoins the shore at Fare Mahora Point, leaving only a boat channel along the shore into Port Beaumanoir. It then trends eastward for about 4 miles, at about 1,000 yards from the shore, past Puuotohe Pass as far as Vaiau Pass, situated opposite a valley of the same name.

Beyond Vaiau Pass, it trends east-southeastward for 1 mile and then turns sharply to the northward to within 200 yards of the shore, from which it is separated by Tutataroa Pass. It thus forms a point beyond which the line of reef continues in a series of coral banks along the coast at about 1 mile from the shore.

Inside this line of reefs are some basins of deep water, which are, however, much encumbered by coral patches, and the passes through the reefs are narrow and often shallow, so that they can only be made use of in fine weather.

Taomaere Channel.—This channel, which leads out of the southwest end of Teahupu Basin, is only navigable for small vessels of less than 120 feet in length. The current runs at times as much as

5 knots toward Havae Pass. The seaward side is the less dangerous, as the bottom is of sand and friable coral, while on the land side it is very uneven and hard.

Ava-ino Pass is about 600 yards wide, but is only a bar which ought never to be used by vessels. Boats can only enter when the sea is calm, and have always to be careful of the blind rollers.

Havae Pass is at the southeastern end of the basin of Teahupu, near Fare Mahora Point and opposite a ridge which separates the valleys Mahire and Vaiaia.

This pass is straight, deep, and clear, 200 yards wide and 400 yards long, opening out into a small circular basin, where anchorage may be obtained in 13 fathoms, sand, with swinging room of 200 yards. This basin being open to the pass, is not sheltered from the swell from southwestward, and can only be considered a temporary anchorage.

Teahupu Basin.—On its northwestern side is the channel, 50 yards wide and 300 yards long, leading into the narrow but well-sheltered basin of Teahupu, where the holding ground is good; but, when anchored in the middle, there is less than 150 yards swinging room.

Port Beaumanoir or Toanoano (lat. 17° 51′ S., long. 149° 12′ W.).—The basin, 3 miles long and about 800 yards wide, between the barrier reef and the shore, commences at Fare Mahora Point and extends eastward as far as the valley of Vaiarava, where its waters join those of Port Vaiau by the Puforatiai Channel. It has general depths of from 13 to 22 fathoms, sand and mud, and good holding ground.

The port is clear of dangers except that from a low point about at its center, a reef extends 300 yards from the shore. The port is closed at its western end, except for the small boat channel already mentioned.

A pathway leads up the Vaiarava Valley and through a gorge to the northern side of the peninsula, and it is the only practicable pathway across the peninsula.

Puuotohe Pass, about 1½ miles eastward of Havae Pass, is nearly 400 yards wide, but the eastern side is occupied by a shoal, which leaves a channel about 50 yards wide, and 3¾ fathoms deep, practicable only in fine weather. The pass is only 100 yards long and opens out quickly after the breakers are passed into Port Beaumanoir.

Vaiau Pass.—Vaiau Pass, near the southern end of the peninsula, lies opposite Mount Faretua, a large mountain whose summit, 3,189 feet high, is well marked. The break in the reef is 200 yards wide, but a reef awash divides it into two channels. The eastern channel is narrow and winding, and, although 4¼ fathoms deep, is only practicable for boats in fine weather. The western channel is 100 yards wide, but has a small coral head, on which are 2¾ fathoms, projecting a short distance northwestward of the middle reef. The outer point of the western reef extends 400 yards seaward, but is steep-to inside the pass.

Vaiau Port.—Inside the barrier reef is the open space called Port Vaiau, about 1 mile long and 600 yards wide, with depths of from 10 to 22 fathoms, mud, its western end opening into Port Beaumanoir. Although containing a great number of isolated shoals, it affords fair anchorage in 16 fathoms, with 270 yards swinging room, southwestward of Maraetiria Point, the low projection formed by the deposits of Vaiau River.

There are two openings into Port Vaiau, viz, that just described, and the Tutataroa Pass.

Tutataroa Pass is situated between the shore and the barrier reef, which turns to the northward toward the coast at about 1 mile eastward of Vaiau Pass. It is 200 yards wide and 800 yards long in a westerly direction; the fringing reef does not extend more than 100 yards from the beach, but is prolonged at the entrance by a small patch of 6 feet, which leaves the deep channel nearly 150 yards wide; another patch projects from the fringing reef where the pass opens into Port Vaiau. The barrier reef is steep-to on the southern side of the pass.

East coast—Aspect.—From Tutataroa Pass the southeastern coast of Taiarapu Peninsula, trends eastward 2 miles to Rapae Point, and then northeastward 2 miles to Vaiote Valley, opposite which the barrier reef, awash, recommences.

The part of the coast not defended by barrier reef, awash, presents a very different appearance to that part which is so defended; the mountains fall precipitately to the sea, forming a line of steep cliffs, against which the sea breaks furiously with fresh breezes from the eastward.

Faratara Reef.—The barrier reef, as a series of submerged reefs named Faratara Reef, lies from 1 to 1½ miles to seaward. This reef and bank has from 2½ to 11 fathoms over it, and the heavy swell from the southwestward which strikes upon it, together with the sea raised by easterly winds, cause tremendous breakers.

Between the Faratara Reef and the shore there is deep water interspersed with banks; the whole vicinity should be carefully avoided.

From Vaiote Valley the coast trends northward for about 3 miles to the fine valley of Vaitoto. Very little is known about this section.

Barrier reef.—The reef awash, which commences off Vaiote, extends along the coast to the northward about 1 mile from the shore; two wooded islets, named Fenuaino and Tiere, are situated near the southern end of this reef, opposite Tomotai Valley. A pass lying between these islets and the reef of the islet Tehuaroto, near the shore, leads to an anchorage opposite this valley.

Caution—Tomotai Pass.—This is a dangerous pass which has a westerly direction, and, when entering or leaving, it is necessary to keep near the northern reef to avoid some sunken rocks. When Fenuaino Islets are on the starboard beam on entering, alter course to the northward to gain the anchorage.

Aiurua Pass (lat. 17° 49′ S., long. 149° 07′ W.) is about 1 mile 9° of Tomotai Pass; the sharp peak of Mount Teiehe in line with the pyramid at the foot of Mount Aiurua bearing 276°, leads in, avoiding the spit of 13 feet which extends 200 yards from the barrier reef on the northern side of the pass, and reduces the deep water width of the pass to about 100 yards. Inside to the southward is the anchorage already mentioned as also reached by the Tomotai Pass; and to the northward is a good harbor, which communicates with Vaionifa Pass about 3 miles farther north by a deep channel, but in which are many scattered coral patches requiring great care in its navigation.

East coast.—From Aiurua Pass the coast trends northward 2½ miles to Vaitoto Point, where a river of the same name flows into the sea through four mouths in expanding from a single stream through a deep and bold gorge which penetrates far into the interior. The point is the eastern extreme of low land projecting about 600 yards from the foot of the mountains and is formed by the débris brought down by the river.

From Viatoto the coast is bordered by low ground from 200 to 300 yards wide, trending northwestward 3 miles to Tautira Point, from whence it turns westward toward the Isthmus of Taravao.

Tautira Point, on which is an important village, is a tongue of low wooded land about 600 yards wide, extending northward ¾ mile from the general line of the coast and from the foot of the mountains and is formed by the deposits from the Vaitepiha River, one of the largest streams in Tahiti.

The barrier reef fronts the coast from Aiurua Pass to Tautira Point at 1,000 yards and less from the shore, inclosing channels and basins of deep water inside. From Vaionifa Pass it trends northwestward in a straight line, rounding Tautira Point at only 400 yards and breaking off abruptly just westward of the point, where there is a gap with very deep water 800 yards wide before the reef again commences.

Between Vaionifa and Tautira there is a smaller gap about 400 yards wide in which there are only 9 feet water.

Vaionifa Pass is about 200 yards wide, 300 yards long, and open to the northeastward. The point of the reef on the northern side extends eastward about 100 yards, but the remainder of the pass is safe. Inside and just opposite the pass at 200 yards from the shore is a small patch with only 3 feet water, marked by a beacon.

Directions.—To enter the pass steer 234° in mid-channel with the highest peak of Mount Roniu showing over the foot of Mount Vaionifa.

Between this pass and Tautira there is a channel from 400 to 600 yards wide and 2½ miles long which ends in a cul-de-sac at the northern end, with the exception of a small boat passage to the village. There are from 19 to 37 fathoms, mud, almost everywhere, but at the northern end the soundings decrease gradually to 16 and 8 fathoms.

Rock.—Crab rock, marked by a beacon, lies in the fairway of this channel, about 1 mile northwestward of Vaionifa Pass.

Northeast coast.—From Tautira Point the coast trends westward 5 miles to a short distance beyond Pueu village. The general direction is straight, but two low and wooded points, Pihaa and Faraari, project about 500 yards to seaward; the first at 2½ miles from Tautira, the second about 1 mile farther on. The mountains behind, from which numerous cascades descend, are steep and cliffy.

The only large break in the mountains is Haavini Valley, which opens between Pihaa and Faraari Points. The lowland between the foot of the mountains and the sea is very narrow, except at the two points and in the entrance of the valley.

The barrier reef, which, as before described, ends so abruptly westward of Tautira Point, recommences ½ mile farther westward, forming, with the point, Tautira Bay or Cooks Anchorage. It then trends parallel with the coast at 1,000 yards from the shore to a short distance beyond Pihaa Point, where it is interrupted by the broad Taharoa Pass, westward of which it curves around Faraari Point at a distance of 600 yards for 1 mile beyond that point.

These reefs are separated from the shore by passes and basins of deep water named Ports Pihaa and Pueu.

Tautira Bay (lat. 17° 45′ S., long. 149° 09′ W.), or Cooks Anchorage, is formed by Tautira Point and reef on the eastern side, and by the barrier reef on the western side.

It is ½ mile wide, about the same depth, and opens to the northwest, affording protection with winds from northeastward through east and south to west-northwestward, but dangerous with those between north and west-northwestward. Cook anchored several times in this bay, from which circumstance the name is derived.

The depth in the middle of the entrance is from 35 to over 60 fathoms, diminishing gradually to the shore. The bay is clear, except a small patch of 2 fathoms 200 yards southward of the point of reef on the western side. The eastern and southeastern shore is lined with a sandy beach.

Anchorage.—The best anchorage is at about 400 yards from the shore in 8½ fathoms, sand, with the extreme of Tautira Point bearing 45°.

Port Pihaa (lat. 17° 44′ S., long. 149° 11′ W.) is the deep basin, from 600 to 800 yards wide and 1½ miles long, between the barrier reef and the shore, extending from Tautira Bay to Pihaa Point, with depths nearly everywhere of from 16 to 19 fathoms, sand and mud.

There are two openings into this port, that from the eastward from Tautira Bay being 200 yards wide, but divided by a small 2-fathom patch; the other from the westward, from Taharoa Pass, is only about 60 yards wide. There are several small patches and reefs, especially near the eastern end, and anchorage is good in all parts where not encumbered by shoals.

Taharoa Pass and Bay.—Taharoa Pass is a break in the reef about 800 yards wide opposite Haavini Valley. Just within the entrance is Toataa Shoal about 200 yards wide, with only from 3 to 6 feet water over it; the channel on the eastern side is about 200 yards wide, that on the western side 400 yards. There are also three other small patches in the bay from 200 to 300 yards from the shore and almost on the line of points Pihaa and Tautira in one.

The best mark for entering is to steer 163° for the cascade at Pihaa; this leads through the middle of the eastern channel. The barrier reef on the eastern side is steep-to.

Port Pueu.—Between the barrier reef and the shore is a deep channel, which opens out a little westward of Faraari Point and forms the basin 500 yards wide known as Port Pueu, in which the depth varies from 13 to 25 fathoms, sand and mud. Entrance to Port Pueu can be effected either from the eastward by Taharoa Pass or from the westward.

Tiitau Pass.—The channel between the western end of this reef and the isolated patch awash is Tiitau Pass. The deep part is about 300 yards wide.

Two white triangular beacons, one on the beach and the other on Toaputae patch, in line bearing 149° is the leading mark for this pass.

Port Pueu is situated between the barrier reef and the shore near a village of the same name, just westward of Faraari Point; from which point the coast trends westward for 1½ miles to the low point Tiitau, the barrier reef lying parallel with the shore about 600 yards distant for 1½ miles from Taharoa Pass, and ending abruptly 1,000 yards northeastward of Tiitau Point.

At 400 yards westward of this reef, and northward from Tiitau Point, is an isolated patch about 400 yards in diameter, of which the central part is awash.

Caution.—About 1,500 yards westward of Faraari Point, the barrier reef becomes submerged for about 400 yards; on this part there are only about 6 feet water, but in fine calm weather it might easily be mistaken for a pass.

Northeast coast.—From Tiitau Point the coast trends westward to Taravao Isthmus, from thence it turns and trends northward 6½ miles to Boudeuse Pass.

The mountains, which are high and steep behind Pueu, descend in a gentle slope toward the isthmus; they are generally bounded toward the sea by perpendicular cliffs, which overlook a strip of lowland about 200 yards wide.

On the highest part of the isthmus and visible from the sea to the eastward, stands Fort Taravao.

Northward of the isthmus, the mountains, densely wooded, form the coast-line, broken only by numerous ravines, of which the most important are those of Papeivi, Vaitoare, and Faone; the first at 1 mile, the second at 1½ miles, and the third at 3 miles from Taravao.

The barrier reef.—From the isolated patch off Tiitau the greater part of the barrier reef is submerged, but forms a long chain of shoals trending westward for 3 miles to Papeivi Pass, the deep passage which separates it from the reef off Vaitoare. The width of the reef is not more than 200 yards, and the depth varies generally from 9 to 20 feet, though at some places the coral is awash and at others there are 5 or 6 fathoms, forming passes into the basin inside.

Taravao Bay is the large expanse of water between the barrier reef and the shore, nearly 1 mile wide and more than 3 miles long. It is open to the northeastward and exposed to winds from between north and east, as the banks of the barrier reef afford insufficient shelter from the sea which breaks on the beach. The bay is entered by the Tiitau Pass, already described, at the esteran end; by the Motu Nono Pass in the middle, and by the Papeivi Pass at the northern end. The general depth is from 21 to 27 fathoms, shoaling near the shore, and the mud bottom affords good holding ground.

Motu Nono is a wooded islet in the bay inside the line of shoals, 1,000 yards from the shore and 1¾ miles eastward of Fort Taravao. It is surrounded b ya shoal extending nearly 200 yards from its beach.

Two isolated patches lie 296° from Motu Nono, one at 600 yards with 2 fathoms, the other at 1 mile with 2½ fathoms. Another patch, with 6 feet, lies 800 yards 99° from the islet.

A vessel is clear of all danger within the bay with the southern extreme of Muto Nono bearing between 110° and 76°.

Motu Nono Pass is a depression in the line of reefs opposite the islet where there are from 4 to 5 fathoms. To enter by this pass, steer 203° for the middle of the islet, and, after passing the line of breakers, alter course so as to pass at more than 200 yards on either side of the islet.

Taravao Pass.—By steering 245° for Fort Taravao the line of submerged reefs will be crossed at a place where the depth is about 5 fathoms. This line passes within 200 yards of the 2½-fathom patch 1 mile 296° from Motu Nono. In order to give this patch a wider berth alter course to port after crossing the line of breakers, or when the islet bears 138°.

Papeivi Pass, between the extreme end of the submerged reefs and the southern point of the reef off Vaitoare, is about 300 yards wide, with a least depth of 6 fathoms.

To enter the pass steer 222° for Fort Taravao, which course will lead 100 yards clear of the reef off Vaitoare.

Barrier reef.—From Papeivi Pass, the barrier reef, awash, trends northward parallel with the coast at 800 yards from the shore for 1.3 miles, where it is separated by the Vaihi Pass, a narrow and deep channel, 100 yards wide, from the Paratahi Bank, which again extends 600 yards to the northward to the Faone Pass, 400 yards wide, opposite the Faone Valley.

Port Vaitoare is the basin inclosed between the barrier reefs and the shore, where the depth varies from 19 to 27 fathoms, sand and mud. It is clear of danger with the exception of two small patches near the southern end, and the fringing reef does not extend more than 100 yards from the beach.

It is entered either by the Papeivi, the Vaihi, or the Faone Pass; the Vaihi being, however, very narrow. Anchorage may be obtained anywhere.

Northeast coast.—Between Faone Valley and Hitiaa, 4½ miles to the northward, the mountains are very steep, broken by numerous valleys, and in some places towering over the sea. A short distance northward of Faone Valley is a church with a spire plainly visible from seaward.

The barrier reef.—From Faone Pass the barrier reef trends northward at 1,000 yards from the shore for about ¾ mile until opposite the village of Utuofai; here a break in the reef leaves a gap 1¼ miles wide opposite the Popeiha Valley; the reef recommences opposite Faatautia and extends to the northward in a slight curve, at about 800 yards from the shore, for 2 miles to the Boudeuse Pass opposite Hitiaa.

Faone Anchorage (lat. 17° 40′ S., long. 149° 18′ W.).—Between the reef and the shore, northward of the Faone Pass, is an anchorage where protection may be obtained from the eastward, but the swell rolls in heavily from north-northeast or southeast. The depth is generally from 10 to 16 fathoms, sand and mud, gradually decreasing toward the sandy beach which lines the shore.

There are, however, several patches, some nearly awash, so that caution is needed when using this anchorage. The best berth is in 14 fathoms, with the church bearing 214° and Teruafaroa Point 175°.

Port Tematoe.—Inside the reef to the southward of Hitiaa is a deep-water channel about 2 miles in length and 400 yards wide, gradually narrowing near the northern end, with depths varying from 13 to 22 fathoms, mud; it is known as Port Tematoe. The entrance from the southward is 300 yards wide, and anchorage may be obtained in the middle of the channel in about 22 fathoms. At the northern end there is only a boat passage, and the reefs, extending much farther from the shore than in the middle and southern part, are marked at their eastern extremes by 3 beacons and by a small tower.

Northeast coast—Aspect.—From Hitiaa the coast trends northwest rather more than 1 mile to the low woody point, Mata-orio, northward of which is the small bay, Taipahia; from thence it curves northwestward for about 1 mile to Putaiamo Point.

The plain near the coast is from 200 to 600 yards wide as far as Mata-orio Point, beyond which the mountains come close down to the shore. At ½ mile northwestward of Putaiamo Point is Mahaena village and church, where two rivers discharge into the sea near a sandy beach.

The barrier reef.—Northward of Hitiaa Point the barrier reef is broken by Boudeuse Pass, beyond which it trends northward for about ½ mile, with a low wooded islet at each end, viz, Oputotara at the southern and Variararu at the northern end.

Northward of Variararu the reef is submerged for about 1,000 yards, forming a shallow pass, in the deepest part of which is a 3½-fathom channel, practicable only in fine weather. The reef then comes to the surface and trends northwestward about 1 mile to abreast of Putaiamo Point, after which it extends for 1,000 yards, with depths of from 2 to 3 fathoms over it, to Mahaena Pass.

Motu Puuru—Nansouty.—There are two low wooded islets on this reef, one named Motu Puuru, 1,000 yards northeastward of Mata-orio Point; the other, Nansouty Islet, 1,000 yards farther north and 1,400 yards eastward from Putaiamo Point.

From hence to Venus Point the barrier reef does not again come to the surface, but continues parallel with the coast as a chain of shoals, the first of which is the Fana or Artemise Shoal.

Boudeuse Pass (lat. 17° 36′ S., long. 149° 17′ W.) is opposite Hitiaa, between the reef off that point and Oputotara Islet. It is about 800 yards wide, but narrowed on the northern side by a shoal extending about 400 yards from the islet; in the middle of the pass is a 4¾-fathoms patch.

The Boudeuse Pass communicates southward by a boat channel with Port Tematoe, and to the northward with the channels inside the reefs and Nansouty Islet as far northward as Mahaena Pass.

Bougainville Harbor.—Inside the pass, and between the islets and the shore, is Bougainville Harbor, an anchorage named after the celebrated navigator who anchored here in the *Boudeuse* frigate in 1776. It is fairly sheltered, but the bottom is strewn with coral heads, among which Bougainville lost several anchors.

Caution is very necessary, as there are several patches and reefs scattered about.

Mahaena Pass is an opening about ½ mile wide between the submerged reef which extends 1,200 yards north by westward of Nansouty Islet and the southern end of the Artemise Bank. A valley, through which the Faa-iti River runs and discharges into the sea, faces the pass.

A vessel will enter through the middle of the pass by bringing the foot of the hills which border the southern side of this valley to bear 236° and running in on that line.

The Mahaena Pass leads by the Anapu Channel, presently described, to some exposed anchorages to the northward, but the best anchorage may be obtained in from 19 to 25 fathoms, sand and mud, between the Nansouty and Motu Puuru Islets and the shore, sheltered from seaward by the reef which joins the islets. It is, however, open to the northwestward and insufficiently sheltered in that direction by the submerged reefs extending to the northward. There is also anchorage a little farther southward in the little Bay of Taipahia, sheltered by Motu Puuru Islet. The swinging room at these anchorages is very limited, considering the great depth of water, and the swell sets in with winds from seaward.

There are several 2-fathom patches and reefs which must be avoided when picking up an anchorage here.

Northeast coast.—From Mahaena the coast trends northwestward 1 mile to the low point Faaru, then it curves westward for 2½ miles to Onoheha, beyond which it trends northwestward 1½ miles to Faarumai Valley. The mountains are close to the coast, and the only important valley is that of Onoheha, which penetrates far into the island, and has at its head the remarkable mountain Matotea and on its eastern side at the entrance point Rauraia, terminating in a precipitous cliff.

The barrier reef.—From Mahaena around to Venus Point, a distance of 12 miles following the line of the shoals, the barrier reef is altogether submerged and forms a series of dangerous shoals with general depths of about 3 fathoms, but often less, and extending from 1 mile to 1½ miles from the shore.

Between the shoals and the shore are large open basins or roadsteads, in which the depth does not usually exceed 27 fathoms, sand, and averages from 20 to 23 fathoms in the eastern part and from 10 to 12 fathoms in the western part. Anchorage may be obtained in these basins, but the banks are too much submerged to afford shelter from the sea, and they are off that coast of the island which is the most fully exposed to the prevailing wind.

Several wide passes give access to these basins, and in fine weather small vessels can pass over the shoals when sure of the marks; but during the bad season, when the winds blow from seaward, the sea is very heavy upon all the shoals, especially Fana.

Fana or Artemise Shoals (lat. 17° 32′ S., long. 149° 19′ W.), so named from the French frigate *Artémise* having struck on them, extend 2 miles in a northwesterly direction from Mahaena Pass and then turn sharply westward for 2 miles to Onoheha Pass. The soundings vary from 2 to 5 fathoms, except in a sort of pass about 1 mile eastward of Onoheha Pass, where for some distance 4¼ fathoms appears to be about the least depth over the barrier reef.

Clearing marks.—The eastern side of Motu Puuru in line with the western side of Nansouty Islet 158° leads clear of the eastern side of these shoals, a close mark.

The lighthouse on Venus Point, well open of Papenu Point bearing 279° clears the northern side of the shoals. The lighthouse in line with Papenu Point 284° touches the northern edge of the shoals.

Venus Point Light is obscured when shut in behind Papenu Point. It should therefore be kept well open of the land when in the neighborhood of the Artemise Shoals.

Anapu Channel is the northern inshore channel from the Mahaena Pass between the southern end of the Artemise Shoal and Anapu Point. Two banks, Iore Rahi and Iore Iti, with from 13 to 18 feet water, lie in the southern entrance dividing the channel into three. The best channel is that nearest and 300 yards from the shore of Point Anapu. It is about 200 yards wide and leads into the large basin between the Artemise Banks and the shore, and at its northwestern end communicates with the Onoheha Pass.

Caution.—Neither this nor any of the channels inside the reefs should be attempted except when the weather and other circumstances are such that the reefs can be clearly seen from the masthead.

Onoheha Pass is a channel about 800 yards wide opposite the valley of that name, before mentioned; it has upward of 50 fathoms in mid-channel in the entrance between shoals with from 2½ to 5 fathoms on either side.

Mount Matotea a litle open westward of the hills forming the eastern side of the valley 214° leads through the pass at 200 yards from the reef on the eastern side.

North coast.—From Faarumai Valley the coast trends westward 2½ miles to the low point Papenu, which extends 400 yards from the foot of the mountains; the mountains are steep to the coast for 1 mile to Utu Turoa Point, and then recede, forming the valley Papenu, at the entrance to which is a plain 400 yards wide.

Beyond Papenu Point the coast trends westward nearly 4 miles to Venus Point. At 1½ miles from Papenu the sandy beach is interrupted by a hill named Tapahi, of which the sea face is a perpendicular cliff; on the top of the hill is an old blockhouse.

Faarumai Pass, about 400 yards wide, is opposite a valley of the same name, and about 1 mile from Onoheha Pass. Inside the entrance, at 500 yards from the shore, is a shoal on which there are only 2¾ fathoms.

Papenu Pass (lat. 17° 29′ S., long. 149° 24′ W.), 2 miles northwest of Faarumai Pass, is 800 yards wide and about 1½ miles from the shore. A course steered 214° for the foot of the mountain forming the entrance of the valley on the western side leads through the pass. At the head of the valley will be seen the two peaks of Mount Orohena.

Maha Honu Pass, 1½ miles eastward of Venus Point, is 200 yards wide and has from 20 to 34 fathoms between banks over which are from 2¾ to 4 fathoms. Within the barrier shoals there are from 17 to 8 and 10 fathoms, sand. A course steered 146° for the blockhouse on Tapahi Hill leads through the pass.

Port Motu Au.—At nearly 1 mile 99° of the lighthouse on Venus Point is the small wooded islet, Motu Au, less than 200 yards in length northwest by west and opposite direction and lying about 300 yards from the shore, from which it is separated by a 5½-fathoms channel. This islet is surrounded by a reef, awash, extending northward 750 yards from the coast, and prolonged to 900 yards to a depth of 5 fathoms.

Between this reef and the eastern part of Venus Point Reef a pass 550 yards wide and open to the northward gives access to a bay at the head of which the small Pupu River, flowing from the Tuauru Valley, discharges itself.

Anchorage may be obtained in depths up to 32 fathoms, sand, on a gentle slope. With easterly winds there is tolerable anchorage near the reef of Motu Au, but it becomes dangerous when the winds are strong from northeast to northwest. It is sometimes a very useful temporary anchorage when strong westerly or southwesterly winds have made Matavai Bay and the Papiete Pass impracticable.

Murea or Eimeo Island (lat. 17° 30′ S., long. 149° 50′ W.).—Murea Island lies westward of Tahiti, the channel separating them being 7½ miles wide. Murea was discovered on July 27, 1767, and named Duke of York Island; it has a more broken outline than even Tahiti, and its numerous peaks are more distinctly separated.

Aspect.—The highest peak, Mount Tohivea, in the southern part of the island, is 3,975 feet high, but many others in all parts of the island are between 2,000 and 3,000 feet in height. One of the most remarkable, Mount Mouaputa, has a hole completely through it near the summit, through which daylight may be seen on a southeasterly bearing.

The island is almost an equilateral triangle in shape, each side being about 9 miles in length, and the northern side taking about an east and west direction; it is surrounded by a barrier reef, through which are several passes to the basins between it and the shore. On the northern side are two deep indentations named Papetoai and Paopao Bays, which afford snug and safe anchorage; these harbors are scarcely 2 miles apart, but between them rises Mount Rotui with several peaks, the highest of which is 2,884 feet. At the head of the two harbors is a fertile plain, extensively cultivated, surrounding the southern foot of Mount Rotui.

The island is thickly wooded, though some of the peaks are bare, and at the foot of declivities the red ferruginous soil appears only to sustain a thick stunted growth, among which, however, the guava seems to flourish. Streams and watercourses are very numerous, but the only one of importance is that which drains the inner side of the mountains and runs into the head of Papetoai Bay.

Products—Supplies.—At the northeastern point of the island is Temae Lake, which abounds with excellent fish. Coffee, cotton, and sugar grow well, and tropical fruits abound. Fowls, goats, and pigs are found wild in the mountains, the last named attaining almost the size and nature of the wild boar.

Population.—The population amounted in 1892 to about 1,500, mostly Protestant Christians, but about 50 Chinese are employed on the plantation.

Tides.—As at Tahiti, high water occurs about midday and low water morning and evening. The height of the water depends mainly on the state of the sea on the reefs. When it breaks heavily the rise will be about 2 feet, and at such times the water rushes out through the various passes with great strength.

Faaupo Point (lat. 17° 29′ S., long. 149° 45′ W.), the eastern extreme of the island, is low and wooded, and extends more than ½ mile from the foot of the mountains; the coast then trends northwestward 1¾ miles to Aroa Point, where it turns west by south for 2¼ miles to the entrance of Paopao Bay.

Barrier reef.—From Faaupo Point to Aroa Point the barrier reef is so nearly united to the shore as to afford no inner channel even for boats. With this exception, it extends all around the coast at from 600 to 1,600 yards from the shore. Between Aroa Point and Paopao Bay are the two small passes, Ava-iti and Irihonu, leading into the inclosed basins.

Neither of these passes should be attempted by a stranger, nor are they fit for anything but small local craft, the anchorage inside being in shallow water.

Paopao Bay (lat. 17° 29′ S., long. 149° 49′ W.), also called Cook Bay, is a narrow indentation in the land on the northern side of the island, 1,000 yards wide and nearly 1½ miles long. The depth varies from 10 to 18 fathoms, mud, shoaling gradually toward the head of the bay, where there is a small river.

Avaroa Pass is the channel through the reefs into this bay. It is 350 yards wide and 800 yards long in a southeasterly direction, and is safe in all weathers. When in the pass, the western reef is a little above water, but the eastern reef has about 6 feet over it. Mt. Muaputa on a 158° bearing leads up to the pass.

The fringing reef does not extend more than 100 yards from the beach, except off the eastern entrance point, where it projects about 200 yards; but between the fringing reef and barrier reef, on either side of the pass, is a narrow, deep, but blind channel extending about 1,000 yards in each direction and communicating by boat channels only with the passes on each side,

The only danger within the bay is a small 3-foot patch half way up the bay and 300 yards from the eastern shore. Good anchorage may be obtained almost everywhere, except in one or two places where the bottom is coral.

Papetoai (lat. 17° 30′ S., long. 149° 51′ W.), also called Teriu Bay, is on the northern side of the island, about 1½ miles westward of Paopao Bay, and penetrates 2 miles in a southerly direction; it is inclosed by precipitous mountains, rising in Mount Rotui, as before stated, to a height of 2,884 feet. At the head of the bay is an extensive plain where the sugar cane is cultivated, known as the Opunohu Plantation; a factory chimney and a large white house stand close to the beach.

This harbor has the advantage of being easy of access during the ordinary trade wind; several streams fall into it, and that at the head was formerly navigable for large boats for ¼ mile, where the water was quite fresh; it has, however, shoaled and only small boats can now enter.

The entrance to the harbor between the reefs is 300 yards wide and clear of dangers, with the exception of a 2-fathoms patch 750 yards westward of Taiamanu Point and a rock with less than 6 feet water, which lies at the northwestern edge of the reef on the eastern side of Tareu Pass. The eastern side of the bay is quite clean, but on the western side a fringing reef extends from 200 to 300 yards offshore as far up the harbor as the little Bay of Urufura; and there is a detached reef northward of Taiarii Point.

On the western side in the entrance is a passage round the land inside the barrier reef; here there is a landing place at the village of Papetoai, where is the official residence of the French commandant.

To enter the bay, steer 163° for a white square beacon at the head of the bay, which will lead through the pass and up to the head of the bay.

A small landing pier, with a depth of 6 feet at the head, has been constructed at 300 yards southward of Taiarii Point.

Anchorage may be obtained near the head in from 10 to 16 fathoms, mud, with 300 yards of swinging room in all directions; landing can be effected in Urufura Bay or on beach at the head of Papetoai Bay, but the swell sometimes rolls in at the latter place.

North and west coasts.—From Papetoai Bay the coast trends westward 2½ miles to Tehau Point, off which, but within the reef, are the two wooded islets, Tiahura and Fareone; it is fronted by barrier reef at 600 yards from the shore. Taotoi Pass, 2 miles westward of Papetoai Pass, with 5½ fathoms water and 100 yards wide, leads through this reef opposite Tepee Point and into the interior basin on 189° course. The current runs strongly out through this pass.

Barrier reef—Passes.—From Tehau Point the coast trends in a southeast direction 8 miles to Paroa Point, the southern extreme of the island. The barrier reef is about 1,000 yards from the shore and is broken by the four passes, Taota, Avamotu, Matauvau, and Avarapa, of which the first two give access for small craft and boats only to the basins inside, but the last two are larger.

Matauvau Pass (lat. 17° 34′ S., long. 149° 52′ W.) is more than 200 yards wide and has a depth of 8 fathoms; the southern reef is steep-to, but the northern reef has a shoal extending 300 yards seaward which, however, does not narrow the pass which should be entered on 54° course; the peak of Mount Muroa bearing 45° leads directly up to the entrance.

Port Haapiti.—There is good open space for anchorage inside in from 7 to 16 fathoms, during the prevailing easterly winds; but these winds render it almost inaccessible to sailing vessels of large size on account of the squalls and baffling winds from the mountains.

Avarapa Pass is directly opposite Point Tuarea. It is 300 yards wide, but only 19 feet deep; the sea is generally heavy in this neighborhood and the pass frequently impracticable. The vertical cliff on the western side of Mount Tamarutofa bearing 12° leads up the middle of the pass and into Vairapa Bay, where there is plenty of water, but the shelter is not good, and there is no passage eastward or westward within the barrier reef except for boats.

South and east coasts.—From Paroa Point the coast trends easterly rather more than 1 mile to Nuupere Point, which is low, and from thence to Faaupo, the eastern point of the island, the general direction is about northeast by north for 6½ miles, with several small bays backed by high and rugged mountains.

The barrier reef is about 1,000 yards from the shore, through which are the three passes, Teruaupu, Tupapaurau, and Vaiere, leading to the basins and channels within the reef.

Teruaupu Pass (lat. 17° 33′ S., long. 149° 47′ W.) is about 1¼ miles northeastward of Nuupere Point and fronting the Haumi Valley; it is deep, 300 yards wide, and the reef on the southern side is steep-to; it leads into a basin which has from 20 to 25 fathoms, and extends to the southward with a gradually narrowing channel beyond Nuupere Point, and to the northward beyond Pohatuao Point, but in the northern part there are several dangerous coral banks with deep channels between.

This pass should be entered steering about 296°, and it opens out on both sides immediately within the outer reefs.

Tupapaurau Pass, 1¼ miles farther northward, is 400 yards wide, but has only a depth of 3¼ fathoms in the deepest part. In heavy weather the sea breaks right across, and in the finest weather it is only available for small schooners and boats.

The leading mark for this pass is a cascade seen between two mountains on with the Protestant Church, a large white building near the shore, bearing 296°.

Motu Ahi.—Just northward of the Tupapaurau Pass is the small wooded islet, Motu Ahi, standing on the barrier reef.

Vaiere Pass (lat. 17° 31′ S., long. 149° 45′ W.), nearly 2 miles southward of Faaupo Point, is 200 yards wide and 400 yards long; the reefs are steep-to on both sides and the water deep. On the reef on the southern side of the pass is the small low bare islet Motu Pehue.

Inside this pass, which may be entered on a 281° course, is a wide and deep basin, perfectly protected from the sea and affording anchorage in from 19 to 27 fathoms mud.

When near the reefs it is well to steer by eye, between them, as the 281° course leads close to the northern reef.

The little bay of Vaïere faces the pass, and from this bay there is a pathway leading through the mountains to the northern valleys and the Opunohu plantation.

Channel between Murea and Tahiti.—This channel should never be used by sailing ships except with steady winds from northeast or southwest, as these are the only winds that blow through the channel. When there is a fresh breeze from the eastward to the nortward of Tahiti it is generally calm in this channel, and vessels have remained becalmed here for days, while a fresh breeze prevailed to seaward.

The northwestern coast of Tahiti should not be closely approached, as a portion of the westerly current striking against Murea is thrown back toward that part of Tahiti, and sets directly upon the barrier reef. The remaining portion usually turns southwestward down the coast of Murea; but the currents and eddies in this channel are very variable and uncertain.

At times, when there is a meeting of easterly and westerly winds in this channel, a heavy sea is raised, having the apearance of a line of breakers; this is dangerous for boats, especially off the eastern point of Murea Island, against which the current sets, and which should under all circumstances be given a wide berth.

Steamers from the southwestward using this channel at night should make the light on Venus Point after passing the southern point of Murea, before keeping to the eastward.

Tetiaroa (lat. 17° 6′ S., long. 149° 30′ W.) is an atoll resembling those of the Tuamotu Group, on which are a number of small low islets with many coconut trees. The atoll is about 6 miles in length east and west by 3 miles in width and lies 26 miles northward of Tahiti. It consists of a reef, surrounding a lagoon, through which there is no pass affording an entrance, so that small boats or canoes wishing to enter must land on the reef and be hauled over it.

These islets produce copra, fish, and firewood. They are worked by labor imported from Tahiti.

Tubuai Manu (lat. 17° 38′ S., long. 150° 37′ W.), also called Saunders Island and Maia-iti by the natives, lies 41 miles westward of Murea and was discovered on July 28, 1767; the greatest length from east to west is about 6 miles; at a distance it has much the appearance of a ship under sail. In the center of the island is a hill with a double peak, the highest point being 780 feet above the sea. This hill is surrounded by a fertile plain and the lower ground abounds with coconut trees.

Tubuai Manu is surrounded by a barrier reef, awash, at about one mile from the shore, and on the southern side is a pass practicable for boats and small craft.

Population.—In 1892 the island had a population of about 200, who are under the district government of Huaheine.

Huaheine (lat. 16° 45′ S., long. 151° W.), the easternmost island of the Leeward Group of the Society Islands, was discovered by Cook in July, 1769. It is about 20 miles in circumference and is divided into two at high water, the northern portion being named Huaheine Nui, and the southern portion Huaheine Iti; the isthmus connecting them is sufficiently covered at high water to form a boat passage.

With southeasterly winds the land is generally covered with clouds and hidden by rain squalls, especially during the night, when it is imprudent to approach it. In thick weather the northern point is the best landfall.

The mountains attain an extreme height of 2,331 feet in Mount Turi in the northern section; they are of volcanic origin, green, and partly wooded, especially the northern part. There is no continuous plain between the mountains and the shore, except in the north and northwest; but there is in most places a narrow strip of fertile land near the shore; the products are similar to those of Tahiti, but come earlier to perfection.

Population.—The inhabitants are of the same race and speak the same language as the Tahitians. In 1892 they numbered in all 1,300 persons, of whom a few were Europeans, and nearly all Protestants. The principal village, Fare, is on the northwestern side of the island.

Barrier reef.—The entire island is surrounded by a barrier reef, but around the northern end, almost from the Farerea Pass on the eastern side to Fare Harbor in the northwest, the reef is more of the nature of a fringing reef, for it is so raised and connected with the shore as to have become solid land, wooded almost to its exterior edge, and forming a cultivated plain. Between this plain and the original shores of the island are lagoons, which communicate with the sea on the northeast by the Tiare Pass.

On the western, southern, and southeastern sides the reef is of the true nature of a barrier reef, with several islands on it, and varies between being awash and having some 16 feet over it, its outer edge lying from 1,600 yards to 1¼ miles from the shore.

Passes.—Through it there are five passes, three—the Araara, Farerea, and Tiare—on the eastern side, and two—the Avamoa and Avapeihi Passes—on the western side.

Araara or Southeast Pass (lat. 16° 49′ S., long. 150° 58′ W.) is at the southern end of the island, between Tiva Point and the island of Motu, Araara, on the barrier reef to the eastward.

The pass has only a depth of 16 feet and is full of coral patches, on which the sea always breaks. It is considered dangerous, even for very small craft. It communicates by boat channels inside the reefs with Farerea Pass.

Maroe Bay.—It leads into a good and very extensive anchorage in the large bay of Maroe, nearly 2 miles long and from 800 to 1,600 yards wide, with depths of from 12 to 22 fathoms.

Maroe Bay communicates at high water by boat passage across the isthmus, as before mentioned, with Port Bourayne, on the western side of the island.

Farerea Pass, on the eastern side, about the middle of the island, is deep and practicable for any class of ships.

Tiare or Northeast Pass is deep but very narrow and lies between the two wooded islands on the barrier reef, named Motu Pahare and Motu Vavara. It is the entrance to Faie Bay, and also communicates by boat channel with the lagoons to the northward and with Farerea Pass to the southward.

Fare and Haavai Harbors (lat. 16° 42′ S., long. 151° 1′.W.).—These harbors are at the northwestern end of the island. The two western passes, Avamoa and Avapeihi, both lead into them, and from them a deep water channel extends to within one mile of the southern point of Huaheine Iti. The principal entrance, Avamoa Pass, is just southward of the northwest point, and facing the village of Fare 1,400 yards within it; and Avapeihi Pass, nearly one mile farther southward, is marked by a small wooded cay on its southern side, and is the most direct channel into Haavai Bay or Cooks Harbor, which extends with not less than 10 fathoms, upward of 1 mile from the entrance.

The two passes are connected by a narrow but deep channel inside the barrier reef, awash, which separates their entrances.

Avamoa Pass has central depths of from 15 to 20 fathoms and as little at 10 fathoms in its widest part; it is 350 yards wide between the reefs, which, however, are not steep-to, but shelve toward the channel reducing the width above a depth of 5 fathoms in one part to only 150 yards; there is also a 1-fathom patch southward of Teopape Point, and but little more than 100 yards northward of the mid-channel leading mark, which is a remarkable mountain at the head of Haamene Valley in line with the beacon with white triangular topmark on the beach, bearing 127°. This leads through the pass in about 10 fathoms least water.

The beacon appears from the sea, when on the line for entering, about midway between the Queen's flagstaff on the left and the white Protestant church on the right. It is reported to be partly hidden by trees, and not to be depended on.

Anchorage may be obtained in from 10 to 16 fathoms, mud, opposite Fare village. Large vessels should moor head and stern in the direction of the pass.

Avapeihi Pass is straight and has about the same width and depth as Avamoa, and like it, is accessible to the largest vessels at all times.

The summit of Mount Puuaretu bearing 99° leads directly through the pass, and when within 600 yards of Papatea Point a vessel may keep away and anchor in Haavai Bay, or in the wide and deep channel extending to the southward between the barrier reef and the shore.

Pilots can be obtained for either pass if required.

Tidal influences are very slight here, the spring rise being only estimated at 1 foot.

Port Bourayne (lat. 16° 46′ S., long. 151° 01′ W.) is about 1 mile long by 1,400 yards wide, and is only separated from Maroe Bay on the eastern side by the isthmus before described; it is 3 miles southward of Avapeihi Pass and is approached by it and the deep inner channel between the barrier reef and the shore. In the entrance to the port is Vaiorea Island with a channel on each side but that on its southern side would appear to be the best.

There is good anchorage in the port, which is quite free from dangers, in 15 or 16 fathoms.

Teapaa and Haapu Bays lie 1,000 yards and 1.3 miles, respectively, southeastward of the entrance to Port Bourayne and both are approachable by the deep but rapidly narrowing inner channel.

Raiatea and Taha Islands.—These two islands lie about 20 miles westward of Huaheine and are only 2 miles apart. Together they occupy a space 23 miles in length north by west and south by east by an extreme width of 10 miles. They stand on one submarine base and are encircled by one barrier reef, broken by ten passes, of which eight lead into the anchorages of Raiatea, and two to those of Tahaa. Both islands are of volcanic origin, and Raiatea, the southern, is about double the size of Tahaa, the northern island.

The population of the two islands amounted in 1892 to about 3,000.

Raiatea (lat. 16° 50′ S., long. 151° 25′ W.) is about 30 miles in circumference, of a mountainous character, covered with vegetation and well watered; the highest peak, in the middle of the island, is 3,389 feet high.

Barrier Reef.—At from 1 to 2 miles from the shore is the coral barrier reef, of which the eastern and western sides in the gap between the islands curve inward so as to approach each other to a distance of 3½ miles, enclosing a large space with much deep water, but with many large coral ledges and some islets. There are also several islets on different parts of the encircling reef, and between the reef and the mainland are several excellent anchorages.

The principal articles of export are cotton (pressed into bales at a factory near Teavarua) and copra; but the greater part of the island, though most fertile, especially in the southern part, is not even under cultivation.

Currents and tides.—The current near these islands generally sets to the northwest at from 15 to 20 miles a day, sometimes less, and sometimes there is no perceptible current; but though its strength is so variable, it rarely sets to the eastward. Inside the reefs, the tidal streams are felt, the ebb generally stronger than the flood. The rise and fall of tide does not exceed 1 foot. The time of-high and low water, and the direction of the tidal streams are much affected by the state of the sea, which, when heavy, runs over the reefs in large volumes.

Teavarua Harbor (lat. 16° 44′ S., long. 151° 26′ W.), also called Uturoa, near the northern end and on the eastern side of Raiatea, is the port most frequented and one of the best anchorages. The village is the residence of the Queen and the seat of government; it extends a mile along the shore, commencing nearly a mile northward of the pass; and the port is the space, about 500 yards wide, between the barrier reef and the fringing reef.

Teavarua Pass (Te Ava Piti) consists of two principal entrances, the north and south passes, one on either side of Taoru, the southernmost of two islets covered with brushwood and coconut trees. Caution is necessary when entering, as the tide sets across the channel at times; the flood setting northwestward and the ebb southeastward.

North Pass is nearly 150 yards wide and lies between the islands Tetaro and Taoru, 400 yards apart, the reef extending into the pass a considerable distance from both islands.

Two beacons give the line of direction for this pass, 269°; the front beacon, with a rectangular topmark, stands on a shoal in Tubua Bay; the rear one, with a triangular topmark, on the beach of the bay. When in line, they lead through the center of the pass but over a 6-fathom patch in the entrance. The beacons are not to be depended on.

South Pass is over 100 yards wide and lies between Taoru Island and the southern barrier reef. This pass is not much used except by small sailing vessels.

Thisbe anchorage.—The depth of water inside the reef is from 18 to 24 fathoms, and the holding ground is good. Thisbe anchorage to the northward, off the village, is considered the best, and the channel up to it is 250 yards wide and clear of dangers.

There are passages out of Teavarua harbor to the northward and to the northwestward, inside the reefs, as presently described. That to the northward is called the Tahaa Pass, and that to the northwestward the Motu Tabu Pass. If bound westward, much distance and time are saved by the latter channel, but it should not be attempted without a good pilot.

Pier.—A stone pier, 440 feet long, with a depth of 9 feet at the end, lies 600 yards southeastward of Regent Point.

Beacons.—A white pyramidal wooden beacon is situated on the edge of the reef at 800 yards eastward of Regent Point.

This beacon, in line with the east extreme of Tetaro Island, bearing 134°, leads 200 yards northeastward of the shoal northward of Regent Point.

A tripod beacon has been erected westward of the southern entrance to the channel for canoes, at about 1,200 yards north-northwestward of Regent Point.

Buoy.—A small black can buoy marks the south end of the shoal situated ¼ mile northward of this point.

Water.—The best watering place is in a small bay southwestward of Taoru Island, about 1½ miles from the anchorage. Small craft can go alongside a factory at the head of the bay, from whence water can be obtained with about 160 feet of hose.

SUPPLIES.—Fresh meat, fish, and vegetables can be obtained.

North coast—Motu Tabu Pass—Beacons.—From Regent Point the coast curves around westward for about 1½ miles to Motu Tabu, the low northern point of the island, off which is a detached patch marked by a beacon. A little farther northward is the Great Central Bank, awash about midway between the two barrier reefs and between the northern and southern ends of the two islands; the southeastern end of this reef is also marked by a beacon, and the Motu Tabu Pass is the channel between these two beacons. By it vessels pass around to the Rautoanui Pass and thence to sea; the whole channel is wide and deep enough for the largest vessels. The British naval vessel *Cameleon* used it in 1885 and reported having found nothing less than 8 fathoms.

Tahaa Pass—Beacons.—Tahaa Pass leads up eastward of the Great Central Bank and Tahaa Island and inside the eastern barrier reef. It enables large vessels to proceed from Teavarua to Tahaa. It is 300 yards wide at the narrowest part and presents no difficulties, as a coral beacon marks the southeastern extreme of the Great Central Bank, and another the western salient point of the eastern barrier reef. In the open space northward of the Great Central Bank there is a shoal marked by a beacon on its northwestern side.

Iriru Pass and Faaroa Bay (lat. 16° 48′ S., long. 151° 22′ W.).—Iriru Pass, on the eastern side of Raiatea, is 3¼ miles southeastward of the entrance to Teavarua Harbor and is barely 200 yards wide between the edges of the reefs, near each end of which are wooded islands.

The leading mark is a small peak just eastward of the peak of Mau Fenua, 1,184 feet in height, in line with the right-hand sandy beach of the small islet Hinahuruvi 243°. When through the pass, this islet should be left on the port hand and a midchannel course steered up the fiord-like Bay of Faaroa, which recedes about 2 miles, has no central dangers, and for a width of about 500 yards affords anchorage in from 16 to 8 fathoms, mud.

Passes.—There is a deep-water passage inside the barrier reef on both sides from this pass, but both have many coral patches; that leading to the northward is buoyed, the reef making off from Opeha Point being marked by a black buoy, and a small 1¼-fathom patch northeastward of it by a red buoy; the channel lies between these two buoys. The passage to the southward and around the southern end of the island as far as Haaio Island, opposite the entrance of the Nao Nao Pass, is deep enough for the largest ships, but would have to be buoyed, as it is most intricate.

Teava Moa Pass (lat. 16° 50′ S., long. 151° 20′ W.), 3.3 miles southeastward of Iriru, is good but narrow, having a depth of about 22 fathoms, and leads to anchorage in Hotopuu and Toahiva Bays. It also gives access to the deep-water channels northward and southward inside the barrier reefs. The pass may be navigated by the eye, as the reefs are awash and steep-to on both sides. A small islet scarcely above the water level is on the edge of the northern reef.

Toahiva Bay.—Good anchorage, in a depth of from 16 to 18 fathoms, is found in this bay, and vessels of 10 feet draft can anchor on the southern side of the bay near the village of Opoa.

Barrier reef.—About 1 mile southeastward of the Teava Moa Pass is the small island of Oatara, near the outer edge of the barrier reef, which at this point turns to the southward for about 2 miles and then to southwestward for 6 miles to the entrance to Nao Nao Pass. There is no break in the whole of this length of reef, and it varies from being nearly awash to having about 10 feet over it, as it does again from this pass around the southwestern end of the island to the Punaeroa Pass.

Nao Nao Pass (lat. 16° 55′ S., long. 151° 24′ W.), just eastward of the wooded island of that name standing on the inner part of the barrier reef, is only 100 yards wide and is crossed by a narrow bar with only 22 feet of water, causing the sea to break heavily completely across in bad weather. Immediately inside it opens out into a fine open space with good anchorage anywhere around Haaio Island. Nevertheless, from the nature of the entrance, this pass can only be considered fit for small craft in fine weather.

The passage inside the reefs between the Nao Nao and Punaeroa Passes is barred to all but boats and very small craft by coral reefs with from 3 to 18 feet over them, especially between Putete Point and the western side of Tuuroto Bay, after which it again opens out into a good channel to the northward.

Punaeroa Pass (lat. 16° 54′ S., long. 151° 28′ W.), on the southwestern side of Raiatea, is good and leads to an extensive anchorage in 15 fathoms, mud. It is 270 yards wide, has a least depth of 29 feet on the leading line, and with the prevailing easterly winds the sea is generally smooth.

To make and enter the pass steer 71°, with the vertical western fall of the mountain called the South Summit on with a smaller summit visible below it.

Taomaro Pass, 2½ miles northward of that last described, is a good channel 160 yards wide between two wooded islets, having a depth of 9 fathoms. It leads to good and safe anchorage inside the reefs, also to the little Port of Vaiaeho, and by a deep and intricate channel communicates with the pass to the southward, but not to the northward.

Tiano Pass communicates with Tetoroa Bay, but is a cul-de-sac having no connection with the passes northward or southward of it. The pass is both difficult and dangerous, and is not recommended.

Rautoanui Pass and Pufau Bay (lat. 16° 46′ S., long. 151° 29′ W.).—The entrance by Rautoanui Pass, on the western side of Raiatea, is formed by a gap in the barrier reef about 400 yards wide, but as shoal water of only from 6 to 12 feet extends 100 yards from each reef into the channel, the navigable width is rather less than 200 yards. On the inner side of the northern barrier reef is the small wooded island Tahu-Naoe, and on the southern barrier reef, the sandy islet Torea. The general direction of the pass is east and west, and the anchoring depth from 20 to 24 fathoms, soft mud.

To approach the pass from the southwestward, a good leading mark is the western tangent of Mount Tapioi, the northernmost peak of the ilsand, in line with the eastern tangent of the island Tahu-Naoe 63°.

There is a deep water but very intricate channel for 3½ miles to the southward inside the barrier reef; it communicates eventually with the Tiano Pass, but can only be used by those with good local knowledge.

On the southern side of Mirimiri Point is Pufau Bay, affording a very confined anchorage with muddy bottom.

The inner channel to the northward is that used, as before described, in connection with the Motu Tabu Pass by vessels passing around the northern end of Raiatea. Its narrowest part is off Tenape Point, and here the salient point of the fringing reef is marked, as are several salient points on both sides, by a conical beacon. These beacons are built of coral and are all about 6 feet above the water level.

It should be remembered that shoal water off Farepoe Point extends beyond the edge of the reef.

Tahaa (lat. 16° 38′ S., long. 151° 29′ W.), about 2 miles northward of Raiatea and within the same barrier reef, is about half the size of that island, being about 15 miles in circumference, nearly circular, and not so fertile. The highest peak, Mount Ohiri, is 1,936 feet high.

Small islands on the outer edge of the barrier reef surround its northern side in great numbers, many of them wooded, and the reef generally is full of coral patches, some almost awash, and in other parts with 10 or 12 feet over it.

There are two passes only through this barrier reef into the inclosed basins, that of Toahotu on the eastern side, and Paipai on the southwestern side of the island; but there is a practicable deep-water channel completely around the island inside the barrier reef, and only rendered intricate in one part, viz, at the northern end, by detached mid-channel reefs.

Toahotu Pass (lat. 16° 39′ S., long. 151° 25′ W.), 300 yards wide, is deep and clear of dangers, and may be recognized by the two islets Mahea and Toahotu on the northern and southern reefs, respectively.

Inside and southward of the pass is Hamene Bay, and northward of it Teoneroa-Haaoa Bay, in both of which good anchorage may be obtained in from 16 to 25 fathoms.

The leading mark for this pass is Mount Puraution with a remarkable hill on Pataia Point 294°. This line leads over patches of 19 feet within the pass.

Tahaa, the principal village, is built on the southeastern point of the island, about 2 miles southward of Hamene Bay; good anchorage may be obtained off it in from 16 to 22 fathoms, mud, good holding ground.

The best anchorage is in the direction of the prolongation of the pier with Toamara Point in line with Fatu Fatu, a low rocky islet to the southward of the village.

Near Fatu Fatu the holding ground is not so good.

The village may be recognized by a church and flagstaff.

Paipai Pass (lat. 16° 39′ S., long. 151° 31′ W.), on the southwestern side of the island, is 300 yards wide and 1,000 yards long in a northerly direction and is deep and clear of dangers.

The leading mark up to the pass is the first ravine westward of Mount Purauti on with Tiamahana Point 39°. As the pass is entered a vessel requires to haul up to 9° direct for Pari Point until through the pass.

Anchorage may be obtained in Hurepiti Bay in from 20 to 25 fathoms.

Bora Bora (lat. 16° 31′ S., long. 151° 45′ W.), always spoken of as one island, is in fact two, the western and smallest island being named Tupua Island, and a barrier reef encircling both. Bora Bora lies about 10 miles northwestward of Tahaa.

Barrier reef.—The barrier reef around the eastern, northern, and part of the western side is covered with islets, mostly wooded, and much larger than those on the reef surrounding Raiatea and Tahaa; on the southwestern and southern sides the reef has no islands, but varies in depth from nearly awash to about 10 feet; it is nowhere more than 1½ miles from shore, and on it the sea breaks heavily.

Aspect.—Bora Bora is distinguished by a double-peaked mountain named Pahia, 2,165 feet above the sea, in the center and 550 yards eastward of it is Mount Temanu, 2,379 feet high. The island is generally more craggy than the rest of the Society Islands. The eastern side has a barren appearance; the western is more fertile.

Population.—A low plain which surrounds the whole, together with the islands on the reef, contain a numerous population, computed, in 1892, at 600; they are of the Tahitian race, and speak the same language.

Teavanui Pass and Harbor (lat. 16° 30′ S., long. 151° 45′ W.).—Teavanui Harbor on the western side, between Bora Bora and Tupua, is 1.3 miles long northwest and southeast, and averages 1 mile in width, is well sheltered and commodious, and affords anchorage in from 12 to 16 fathoms, sand and mud.

The large village of Vaitape lines the shore on the eastern side of the entrance to the harbor. A flagstaff, with a church and landing pier close by, occupy a prominent central position.

The pass through the reef is 400 yards wide, 800 yards long, and has 5½ fathoms water; it is straight and free from danger. The wind being generally from the eastward blows out of the pass, and the stream generally sets out in strength proportionate to the amount of surf rushing over the reefs.

Leading marks.—The marks indicating the leading line through the pass are two white masonry pillars. The front pillar is 14 feet high and situated on the shore line 700 yards southeastward of Pahua Point.

The rear pillar, about 100 feet above the sea, is 17 feet high and situated 105° from the front pillar, distant 1,200 yards. This forms a conspicuous mark from seaward.

Caution.—The rear pillar is obscured by trees for a vessel coming from the northward until the marks are almost in line.

Directions.—To entet bring the leading beacons to bear 105° and steer in on that course, which will lead through in mid-channel in 51½ fathoms least water, until a small peak, 761 feet high, eastward of Turapao, bears 107°, when steer on that line until nearly abreast of the outer leading white pillar; then haul to the southward and anchor anywhere in the harbor or off the village.

A good berth is with the church bearing 68° and Pahua Point 337°.

A shoal extends 800 yards off the northern end of Tupua Island toward the pass which renders it necessary to observe the leading lines given, and the northern shore may be approached with safety to about 200 yards. The edges of the reefs are clearly visible, but with strong northwesterly winds the sea breaks right across the entrance, rendering it difficult to distinguish the channel.

There is also anchorage in Fanui Bay northward of Pahua Point.

Motu Iti or Tubai (lat. 16° 17′ S., long. 151° 49′ W.), about 8 miles north by westward of Bora Bora, consists of several small and low islands connected by a reef without any opening.

The islands occupy a space about 4 miles in extent in each direction, and the reels do not appear to extend more than a mile from them except to the northward, where they are reported to be as much as 4 miles from the land.

Turtle are said to abound here, and it is much resorted to by the natives of the neighboring islands for fishing purposes, and to collect coconuts, but it is not permanently inhabited.

Marua, also called Maupiti (lat. 16° 27′ S., long. 152° 12′ W.), lies about 23 miles westward of Bora Bora; it is about 6 miles in circumference, small, with a population of about 300, and comparatively high, the highest point being 800 feet above the sea.

Barrier reef.—It is surrounded by a barrier reef on which and inclosed by which are numerous small islets covered with coconut trees. The reef extends nearly 2 miles from the main island on all sides except to the southward where it extends 3½ miles. All the northern outer part of the reef from east to west is well above water and thickly wooded; the southern, except for a few islets, is mostly awash.

Entrance.—The entrance to the lagoon within the barrier reef is at the southern end between two small, low islets, covered with trees, which bear 166° from a very remarkable perpendicular rocky bluff, 700 feet high, resembling the ruins of a gigantic castle, on the southern side of the island.

Depth.—The channel between the islets is narrow and winding; there are 6 fathoms in the entrance, but within it quickly decreases to 4 fathoms, and in the lagoon, which is largely occupied by coral reefs, there are only from 15 to 18 feet. In bad weather the sea breaks right across the entrance, and it is only fit for small craft in fine weather; great care is even then necessary on account of rollers. A strong current always sets out at the entrance and is, as usual, strongest when the surf is heaviest.

Mopeha (lat. 16° 48′ S., long. 153° 55′ W.), about 100 miles west by south of Marau, is an atoll and was discovered in 1767 and called Lord Howe Island; it is also known by the name Mopelia. The atoll was visited again and surveyed in 1893.

Aspect.—Mopeha consists of many low islands on a reef surrounding a lagoon, and occupying a space 10 miles long north and south, and 4 miles wide. The whole eastern side of the reef is occupied by a long, narrow band of dry land with many coconut trees.

On the northern and western sides are numerous islets, many of them with brushwood or trees of various sorts.

Pass.—The only pass through the barrier reef is on the northwestern side; it is only about 30 yards wide, steep-to, and with a depth of 32 feet; but its inner part is almost closed by shoals, so that a small sailing vessel requires to furl sails and warp through into the open water of the lagoon, and this can only be done by sending two boats on ahead with kedge anchors and hawsers to await the vessel's arrival.

The lagoon has plenty of water, but also some shoals easily discernible by the eye; it can not, however, be considered as ordinarily accessible even to the smallest vessels without the greatest care and thorough knowledge of the pass.

The islands are without permanent inhabitants, but they are visited by fishermen for the purpose of catching turtle, which abound in the season for them.

Fenua Ura, or Scilly Islands (lat. 16° 31′ S., long. 154° 43′ W.), is an atoll on which is a group of small, low, and consequently dangerous islands, discovered in 1767.

They are about 43 miles northwestward of Mopeha, and 140 miles westward of Marua, and are uninhabited. The atoll is about 6 or 7 miles in diameter, and the inclosed lagoon has no pass by which it can be entered.

Reef.—The reef on the north, west, and south side of the atoll is awash, but is marked on its west extreme by a block of coral. No bottom at 150 fathoms was found at less than ½ mile from this point.

Bellingshausen Island (lat. 15° 48′ S., long. 154° 33′ W.), another atoll, was discovered in 1824; it consists of four low coral uninhabited islands, covered with coconut trees and other vegetation on a reef of triangular form; the greatest length of the atoll is about 3 miles in a north and south direction.

The reef is steep-to all around, and has a number of large bowlders on it. About a dozen coconut trees show conspicuously above the others, and may be seen 10 miles distant. There is no opening into the lagoon, but the sea flows into it over the reef.

Landing may be effected in fine weather without danger on the west-northwest or lee side of the island.

CHAPTER IV.

RAPA NUI—SALA Y GOMEZ ISLAND—TUAMOTU OR LOW ARCHIPELAGO.

(Lat. 14° 05′ S. to lat. 27° 10′ S.; long. 105° 25′ W. to long. 148° 36′ W.)

Rapa Nui or Easter Island (lat. 27° 08′ S., long. 109° 25′ W.)—**General remarks.**—Rapa Nui, generally known as Easter Island, was discovered on Easter Sunday, 1721.

The island was formally annexed to Chile in July, 1888, and in August, 1889, when visited by the British naval vessel *Cormorant*, it had then a large stock of cattle, sheep, and pigs, also poultry, mostly running wild, and plenty of horses.

Inhabitants.—Until the visit of the British naval vessel *Sappho* in 1882 it was generally supposed from vague native tradition that inhabitants had originally come in a large canoe from Rapa Island, which does not seem probable, as that island is 1,900 miles to the westward, and no canoe could navigate that distance against the usual trade wind. Mr. Alexander Salmon, the agent for the British commercial house of the Maison Brander, of Tahiti, who speaks the native language fluently, furnished Commander Clark, of the *Sappho*, the most reliable account of their native traditions; that they originally came from the east in two canoes provisioned with yams, taro, and sweet potatoes; the king (by name "Hotu metua" or the "Prolific father") in one canoe and the queen in the other. On making the island they separated, passing round in opposite directions and meeting again at Anakena on the north side, where they landed and settled on Mount Hotu-iti. There they built the stone houses, the remains of which still exist, and carved the statues with which the hill is covered, but the first statue was not completed until about 50 years after they landed. The original name of the island was Te Pito Fenua, i. e., the land in the middle of the sea.

In 1863 some Peruvian vessels arrived off the island and carried a number of the inhabitants away to work on their guano islands; in the following year some Roman Catholic missionaries settled in the island to protect and civilize the remainder, who only numbered about 1,500, and rapidly decreased, so that in 1867 only 900 remained.

In 1878 the Maison Brander firm, which had been trading with the island for some years, removed about 500 of the inhabitants to work on their sugar plantations at Tahiti, and purchased the property of the missionaries on Easter Island, who then went with about 300 of the natives to Manga Reva, so that in 1882 visit there were only about 150 inhabitants left.

The natives somewhat resemble the Marquesans, being of a light complexion, and are rather a handsome race. There is a resident native missionary, and they are visited by a priest from Tahiti.

The statues, some of colossal size, which are scattered over the island in great numbers, are most remarkable; they vary in height from 5 to 37 feet, but are usually from 15 to 18 feet high. They are all sculptured from a grey compact lava found in the crater of Hotu-iti, near the eastern end of the island, where there are still many in an unfinished state. Their shape is that of the human trunk, terminating at the hips, the arms close to the sides, the hands in low relief clasping the hips. The head is flat, and the top of the forehead cut off level, to allow of the crown being placed in position; this latter is made of red tuff found in Rano Kao crater. The face is square, massive, and sternly disdainful in expression, the aspect always upward.

Population.—The population of this island in 1911 was about 200 natives and 1 white resident.

Caution—Reported magnetic disturbance.—The captain of the sailing vessel *Knight of the Garter* reports that rounding the Southwest Cape and making Cook Bay he found great magnetic disturbances in his compasses, probably due to some local attraction in the vicinity of the extinct volcano Rano Kao. Special care should be taken therefore when navigating these channels.

Aspect.—Easter Island is triangular in shape and about 29 miles in circumference; it is volcanic and has numerous craters, none of which have been active for many years. The highest part is Rana Hana Kana or La Perouse Mountain, with a crater, near North Cape; it is 1,767 feet high. All the hills are smooth, rounded, and green to the summit, but there are no trees.

The coast is rocky, and there are only two or three sandy beaches in all its extent. On the northern and southern sides the land is high and precipitous.

Near Southwest Cape is Rano Kao, the largest crater; the mountain is 1,327 feet high, and after descending inside the crater for 600 or 700 feet, it is 2½ miles in circumference. At the bottom of this crater is a small lake, covered with decayed vegetable matter, no bottom, with 50 fathoms of line, has been found.

Hotu-iti, or Mount Topaze, about 680 feet high, is another isolated crater in the southeastern part of the island. From the gray lava, of which its sides are composed, the statues previously described were made.

Off Southwest Cape are two rocks, Mutu Raukau or Needle Rock and Mutu Nui or Flat Rock, with deep water between them and the main island. The British naval vessel *Sappho* made use of the inner passage on the way to Hanga Roa and reported them both clear of dangers.

These two rocks were reported (1906) to be situated 1,000 yards westward of their charted position.

Anchorage.—There is no sheltered anchorage anywhere around the island, but as its shores are bordered by soundings of from 25 to 35 fathoms extending from 1 mile to 1½ miles from the land, with sandy bottom and occasional rocky patches, the bottom sloping gradually toward the shore, it is not difficult to pick up a temporary anchorage anywhere on the lee side of the island, and in fine weather it generally falls calm near the land during the night.

Landings.—There are six landing places—Hanga Roa and Hanga Piko on the west, La Perouse Bay and Anakena on the north, and Vahio and Hutuiti on the south, so that a ship can communicate at any time. There is a good landing for boats at Ovnipoo on the south coast between two image platforms.

The landing in La Perouse Bay is about ¾ mile eastward of Ovahe Bay and is marked by a small sandy beach.

Anakena, where there is a spring of fresh water, affords the best landing place. There are no inhabitants at La Perouse Bay, but at Hanga Roa and at Vahio there are Roman Catholic missionary stations.

Hanga Roa or Cook Bay (lat. 27° 08′ S., long. 109° 25′ W.), on the west coast, is a small bay about 1 mile wide between Cook Point and Punta Roa and affords good anchorage from October to April, the season of the trades. During the remainder of the year it is often a lee shore.

The British naval vessel *Sappho* anchored in 14 fathoms, with the village bearing 117° and Punta Roa 207°, but the best anchorage is outside the 16-fathom line, for, inside that depth, the bottom is very hard and nearer the shore there are large bowlders.

The landing in this bay is not very good, the water being shallow inshore with a rocky bottom, but it is quite safe in fine weather.

Hanga Piko, the bay next southward of Hanga Roa, affords excellent landing, but the channel in between the rocks is rather narrow, and, with any swell on, the breakers are rather alarming. However, it never breaks right across, except in a gale, and the passage was improved by the officers of the *Sappho,* who blew up a rock which jutted into the channel on the southern side.

During northeasterly winds vessels can anchor off this bay in a depth of 26 fathoms, sandy bottom.

Supplies.—The island having been leased by the Chilian Government for stock-raising purposes, it has become an excellent place for obtaining live stock. The island has some 10,000 sheep, 300 head of cattle, and 200 horses. Beef, mutton, and poultry can be easily obtained only at Hanga Roa or Cook Bay; sheep, averaging 60 pounds in weight. Bananas and plantains grow in abundance, and can be obtained if time is given.

Water is scarce, but there is a well of excellent water on the hill at the back of the mission house near Hanga Roa, called Puna Pau or "the unfailing spring." It is a curious fact that when a heavy swell prevails on the western side of the island the water rises in this well, although remaining perfectly fresh.

Meteorology.—From observations made on Easter Island during 1905 by the European agent for the Government of Chile the following results were obtained:

Barometer.—Mean for year, 30.124 inches; mean monthly maximum, 30.352 inches; mean monthly minimum, 29.832 inches; highest, 30.472 inches in August; lowest, 29.686 inches in September.

Thermometer.—Mean for year, 70½° F.; mean monthly maximum, 78° F.; mean monthly minimum, 62½° F.; highest, 90½° F. in January; lowest, 56° F. in September.

Rainfall.—Mean for year 4.3 inches; maximum monthly rainfall, 13.4 inches in July; minimum monthly rainfall, 1.7 inches in March. Rain fell during every month, giving 129 rainy days during the year, the greatest rainfall in 24 hours being 3 inches in July. The prevailing winds were from northwest and southeast.

Winds.—From October to April the southeast trade is constant at Easter Island, blowing strongly at its commencement and termination. There are occasional showers during the trade season. From May to September the weather is variable, westerly winds prevailing, at which season there is a good deal of rain.

Thunder and lightning appear to be unknown.

Northerly and westerly winds, known as Papakino, occur mostly in winter, and are accompanied by rain; southwesterly winds, known as Vaitara, occur in the winter months, and are accompanied by rain and a heavy sea.

Variable northeasterly winds (Tongariki) and southeasterly winds (Anoraru) prevail in summer.

Tides.—It is high water, full and change, at 5h. 55m.; springs rise about 2½ feet (approximately).

Communication.—Easter Island is in communication with Chile once a year.

Sala y Gomez Island (lat. 26° 28′ S., long. 105° 28′ W.).—This island was discovered in 1793 by the Spanish commander of that name, and was again visited by the Spaniards in 1805. It is scarcely more than a heap of stones less than ½ mile long in a northwest and southeast direction, and 400 yards wide. In a gale, it would be hardly distinguishable amidst the spray; the highest part at the southeastern end is 98 feet high. The rocks, except such parts as sea birds frequent, are of a dark brown color.

Some sunken rocks lie off the northeastern and southwestern points.

Tides.—It is high water, full and change, at 4hrs.; rise about 4 feet.

Scott Reef, on which the sea breaks, lies about 1 mile northeastward of Sala y Gomez. It is 100 yards long, east and west, and 50 yards wide, with from 16 to 19 fathoms close around, increasing to 40 fathoms at 500 yards from the reef except in the direction of the island, between which and it are depths of from 16 to 33 fathoms.

TUAMOTU OR LOW ARCHIPELAGO.

This vast group, comprising 78 islands, of which the native name until recently was the Paumotu or Submissive Islands, which name was given them by the Tahitians after conquest, has now by the desire of the inhabitants been officially renamed the Tuamotu Archipelago or Distant Islands. The group extends over 15 degrees of longitude, not including the detached islands to the southeastward. The islands, with the exception of Makatea and Tikei, are all atolls, very similar in character and with great sameness of feature.

In consequence of the extent of the archipelago, and the character of the islands composing it, they were naturally discovered only by slow degrees and by many different navigators, whose voyages extended over a long series of years.

Government.—With the exception of the southeastern detached islands, Ducie, Henderson, Pitcairn, and Oeno, the whole group was annexed to France in 1880. The seat of government is at Rotoava village on Fakarava Island.

Standard times of the meridian of 150° W. or 10h. 0m. 0s. slow on Greenwich mean time has been adopted by the French Government for Tuamoto Archipelago.

Population.—The inhabitants of the whole group of these islands in 1905 were estimated at 4,300.

They are not all of the same origin; some resemble the Fijians in figure and in the darkness of their skins; others more resemble the Tahitians, but have a more warlike disposition, and apparently speak a different dialect of the Polynesian language to that of Tahiti. These natives are reported to be honest and trustworthy, and have nearly all been converted to the Protestant form of Christianity. The French Roman Catholics have an establishment in Anaa, another at Manga Reva, and at other places, as hereafter detailed.

Most of the islands are inhabited, but in many the population is extremely variable, the people deserting one island, when the pearl fishery is temporarily suspended, and establishing themselves on another with the greatest facility. The most venturesome navigators are those belonging to Anaa or Chain Island. Their vessels are double canoes about 35 feet long, connected by a strong framework, which hoists two mat sails on separate masts. They do not care to serve for pay in schooners or larger vessels, and show no aptitude for the sailing of such craft. Many of them are expert divers.

Trade.—The trade of the Tuamotu Islands is carried on by merchants of Tahiti, principally British and American, and the commerce is greater than might be supposed. Owing to the steady cultivation of coconut trees, a great increase in the quantity and value of copra exported has taken place of late years. This and pearl shells are the principal articles of trade, and a large number of schooners and smaller vessels are constantly passing and repassing among the islands collecting the produce.

Winds.—These islands lie within the boundary of the regular trade wind, which, except among them, blows with fair regularity the whole width of the Pacific, but from causes not quite satisfactorily accounted for, the land here, though small in area and inconsiderable in height, exercises such an influence as to interrupt the regularity of the trade wind, so that not only does its easterly direction often fail, but heavy squalls from the opposite direction occur, and more frequently by night than by day. This is especially the case from November to March.

The effect of the prevalent southwesterly gales in high southern latitudes in transmitting the heavy sea which is felt many hundreds of miles from the latitudes of its origin occasions a serious obstacle to landing on these low islands by rolling in on the shore in an opposite direction to the trade wind, making it often more dangerous to land on the lee than on the weather side of the islands.

Hurricanes.—In September, 1877, and February, 1878, two hurricanes occured among the islands of the Low Archipelago. They are the first on record and are reported to have caused much damage among the Manuhi or Waterland Island, King George Islands, Kaukura or Aura Island, Fakarava or Wittgenstein Island, and Anaa or Chain Island.

. The sea is reported to have washed completely across Niau or Greig Island, destroying nearly all the inhabitants.

Exceptionally severe weather, accompanied by strong northwesterly winds, was experienced by the British naval vessel *Alert* toward the end of July, 1880, in the vicinity, but southward of the Tuamotu Archipelago. It was afterwards ascertained that at about the same time similar winds and weather were prevailing as far westward in the South Pacific as Tahiti.

In January, 1903, the hurricane that visited the Tuamotu group was most disastrous in its results; the villages of Hikueru, Marokau, and Napuka were swept completely away; in many islands all the small brushwood disappeared and nothing more was seen than vast fields of broken coral thrown up by the sea.

Tidal streams.—In most of the entrances to the lagoons in these atolls there is a strong tidal stream which sets in and out alternately about six hours each way, the rise of tide being about 2 feet. It is high water, full and change, at about 1h. among the western groups and from half an hour to one hour later among those to the southeastward.

Currents.—As might be supposed, amongst such a large mass of islands the currents are somewhat irregular, but during settled weather and a steady southeast trade wind the surface water generally moves westward from 5 to 25 miles a day. In the rainy season, from October to March, when westerly winds, squalls, and rains are frequent, the currents vary most, and occasionally set to the eastward from ½ mile to 2 miles an hour.

Southeastern islands.—Southeastward of the Tuamotu group proper lie the four southeastern islands Ducie, Henderson, Pitcairn, and Oeno, which, from their positions, will be first described.

Ducie Island (lat. 24° 40′ 40″ S., long. 124° 47′ 40″ W., approximately) was discovered by the British naval vessel *Pandora* in 1791.

It is a British possession, having been annexed in 1903.

It is an atoll of coral formation 1¾ miles long and 1 mile wide.

The lagoon in the interior is partly inclosed by trees and partly by low coral flats scarcely above the water's edge. The lagoon appears to be deep and had a boat entrance on the southeastern side, but in 1882 a sandy ridge extending right across the bar, with a heavy surf, completely blocked the entrance.

The height of the soil above the water is about 12 feet and the trees about 14 feet more, making the tops of the trees about 26 feet above the sea.

No living things but birds were seen on the island, and great numbers of fish and sharks abound in the vicinity.

Though the wind was from the north, force 4, a boat was enabled to land on the northern side, but it was necessary to wade, as the coral beach runs out shallow.

Breakers extend ½ mile southward of the island.

Henderson Island (lat. 24° 24′ 45″ S., long. 128° 18′ 30″ W.), south point, also called Elizabeth Island, about 190 miles westward of Ducie Island, was discovered by a boat's crew from the whaler *Essex*, which was wrecked in 1820. It was afterwards seen by Capt. Henderson, of the ship *Hercules*. The British flag was hoisted on this island on July 6, 1902, as a dependency of Pitcairn Island.

The island is 5 miles long north and south, 2½ miles wide near the northern end, but tapering off to a point toward the south, and has a flat surface nearly 100 feet above the sea. It is covered with trees. On all sides except the north it is bounded by perpendicular cliffs about 50 feet high, composed entirely of dead coral, which are considerably undermined by the action of the waves. It appears to be steep-to at a short distance all around.

A dwelling house and six sheds roofed with corrugated iron were situated on the north side of Henderson Island in 1912.

The island presents the appearance of having been raised by some subterraneous convulsion, and is so thickly interlaced by shrubs as to make it very difficult to walk over the summit, the vegetation concealing the cavities in the coral. A few coconut, lime, and orange trees are planted on the beach. Sandalwood seems to grow well. Rats and mice are numerous in the bush beside the north landing.

Reef.—A reef extends about 200 yards from the northwestern point.

Supplies.—Fish appear to be good and plentiful. There is no spring of fresh water, but rain water sufficient to sustain the two men of the *Essex*, who were eventually rescued from the island, was found in small pools.

Landing is extremely difficult on account of the heavy sea rolling in on the coral ledges, and is only possible on the north and west sides of the island.

Pitcairn Island (lat. 25° 04′ 00″ S., long. 130° 05′ 55″ W.) is a British settlement. It was discovered and named by Carteret on July 2, 1767.

The island derives its interest from being associated with the mutiny of the British naval vessel *Bounty* in 1789. That vessel left England in December, 1787, with the object of conveying breadfruit trees to the West Indies from Tahiti, where she arrived in October, 1788, and remained six months collecting trees. The mutiny occurred at sea on April 28, 1789, when the commanding officer and 18 others were set adrift in a 23-foot boat, in which they made their way to Timor, a distance of nearly 3,600 miles.

The mutineers cruised for a short time, touching at several islands, including a return to Tahiti, where they took native wives and a number of native men for laborers. Sailing again, the *Bounty* was eventually run ashore on Pitcairn Island, and one of the most unique colonies in history was established.

The present inhabitants are descendants of the mutineers and number about 150 persons. They are very religious, well governed among themselves, and are eager to barter from their slender supply of fruits and produce for shoes, clothes, beads, and seeds.

Communication.—An average of 19 vessels besides missionary vessels now visit the island annually.

Aspect.—Pitcairn Island is about 2¼ miles long east and west and 1 mile wide; the entire circuit of the island, with one or two exceptions, is perpendicular. The highest part being about 1,000 feet above the level of the sea renders it visible 40 miles distant. The soil is very rich and fertile but porous; a great proportion is decomposed lava, the remainder, a rich black earth. The island is thickly covered to the summit with luxuriant verdure, terminating in lofty cliffs, skirted at their base with thickly branching evergreens.

Adamstown is situated on the northeastern side of the island westward of Bounty Bay.

Anchorages.—The most convenient anchorage from which to communicate with the shore at Bounty Bay, where the natives always prefer to land except in very bad weather, is in from 13 to 17 fathoms, sand, with rocky patches, about 1,000 yards from the shore, with St. Pauls Point on with or just open eastward of Adams Rock; and Young Rock about 284°.

This is an uncomfortable anchorage with easterly winds, in consequence of the ship's uneasy motion. The best anchorage with easterly winds of any strength is off the western end of the island about 500 yards from the shore in about 12 fathoms, with Young Rock bearing about northeast by east and Christian Point south.

Sailing vessels almost invariably stand off and on, and the liability to sudden changes of wind renders it injudicious for them to anchor except when set toward the land in a calm.

Landing.—The precipitous coast of Pitcairn presents insurmountable obstacles to landing, except at two places, viz, at Bounty Bay, on the northeastern side, and at a little cove on the western end of the island; the latter is a good one, with winds from the eastward, but the ascent of the cliffs afterwards is a matter of considerable difficulty and it takes at least an hour to reach the settlement by this route.

Landing at Bounty Bay in ship's boats is somewhat dangerous, and the islanders' boats are nearly always used; in any case, the services of an islander to pilot a boat in to the landing should be secured.

Supplies.—The surplus produce of the island consists of fowls, bananas, sweet potatoes, and other semitropical fruits and vegetables, being bartered in moderate quantities, but the greatly increased frequency of the visits of shipping has somewhat reduced the supply, which is now uncertain.

Water is at times scarce; there are no springs on the island, but generally there is an abundance of rain.

In 1901 the British naval vessel *Icarus* found there was an abundance of water in Browns Well, which is nearly in the center of the island, and has not run dry since the present inhabitants returned from Norfolk Island.

Winds.—There are no regular trade winds at Pitcairn Island. In the summer months the wind prevails mostly from east-southeast to north. Northerly winds are generally light, often accompanied by rain or fog; from north the wind invariably goes around to the westward, from which quarter and from southeast are the strongest gales; when the wind is from the southwest the weather is generally clear with moderate breezes. During the winter season the prevailing winds are between southwest and east-southeast.

Current.—There is generally a westerly current running past the island, which is frequently of considerable strength. During the stay of the *Icarus* the current was found setting to the eastward.

Oeno Island (lat. 23° 55′ 30″ S., long. 130° 44′ 20″ W., northeastern point) is an atoll and was discovered by the *Hercules*, but was named after a whaler, the master of which had not seen it before; it lies 65 miles northwestward of Pitcairn Island and is low and dangerous. This island was annexed on July 10, 1902, as a dependency of Pitcairn Island. Coconut trees were planted on the island. There is a small hut on the island.

Lagoon.—Coral reef completely surrounds the lagoon, near the center of which is a small island covered with shrubs, and toward the northern extreme are two sandy islets a few feet above water.

The lagoon is fordable on the western side as far as the wooded island, but in other places appeared to be 2 or 3 fathoms deep.

Landing is extremely dangerous, even when practicable, and the island is uninhabited. The existence is reported of a channel for boats, through the northeastern part of the reef encircling this island, leading into the lagoon, eastward of sandy islets.

A shallow boat entrance to the lagoon on the northern side of Oeno Island is marked by a solitary coconut tree, which should be brought to bear 179°.

Another entrance is reported to exist eastward of Sandy Islands.

The clump of coconut trees on the northeastern end of the island, together with the solitary tree, are fairly conspicuous.

Water of fair quality is said to be obtainable by digging in the sand.

Minerva or Ebrill Reef (lat. 22° 44′ S., long. 133° 35′ W., approximately), upon which it was assumed that the ship *Sir George Grey* was lost, in 1865, was searched for by the British naval vessel *Alert* in 1880, in the position assigned to it, viz., between the parallels 22° 32′ S. and 22° 45′ S., and meridians 133° 20′ W. and 134° W. No breakers being observed, nor shoal ground found; but in the year 1890, the German bark *Erato* having passed over a shoal in latitude 22° 44′ S., longitude 133° 35′ W., it was considered to be identical with the Minerva Reef.

Portland Bank (lat. 23° 41′ S., long. 134° 35′ W.).—In the year 1853, the British naval vessel *Portland* sailed over this bank at midday, on a northeast course, for 4½ miles, when the bottom was clearly seen, and soundings of 7, 13, and 15 fathoms were obtained. At the western end of the reef, Manga Reva was plainly visible from the deck, bearing 324°, distant 44 miles.

The master of the Chilian brig *Nautilus*, reported in 1887 having anchored in 15 fathoms, on, and examined the Portland Bank. On the shoalest part he found a rocky reef, on which the sea broke heavily; this part appeared to consist of patches, with depths of from 4¾ to 6 fathoms, no part being seen above water. The rest of the bank is aparently of sand, with from 15 to 17 fathoms. On April 2, 1893, the Chilian bark *Antonietta* also passed over the Portland Bank; the captain considered it to be about 7 miles long and 2 or 3 miles wide, and in other respects corroborated the descriptions of the *Portland* and *Nautilus*.

Timoe or Crescent Island (lat. 23° 20′ S., long. 134° 29′ W.), the southeasternmost island of the Tuamotu Archipelago proper, was discovered by the ship *Duff*, in 1797. It is 3½ miles in length, 1½ miles wide, of similar formation to Oeno and Ducie Islands, and without inhabitants. It consists of a strip of coral about 100 yards wide, about 2 feet above water, inclosing a lagoon into which there is no passage. Upon this strip of coral are several small islands (the highest being about 6 feet above the sea) covered with threes nearly 20 feet high. Landing appeared impossible on account of heavy surf.

Manga Reva or Gambier Islands were discovered May 25, 1797, and named Gambier Islands. The group consists of a barrier coral reef, inclosing four small inhabited islands and numerous islets. They are of some importance to the navigator, inasmuch as they afford a somewhat indifferent supply of water as well as plenty of fish, a few fowls, goats, and considerable quantities of oranges, coconuts, and other tropical fruits.

Population, etc.—In 1879 these islands contained a population of about 1,000, but in 1894 the total inhabitants were only about

500, and of these at least 100 were not native born; at the same time it was said that 30 years previously the population had been 4,000. The French authorities attribute this wholesale deterioration to the generally low type of the people, who appear to have adopted all the bad habits of Europeans and none of their good ones; they are represented as being of poor physique, gentle, and honest, but idle, drunken, and dissolute. Their principal occupation is the mother-of-pearl fishery.

The united population of the Gambier and Austral Islands in 1905 was estimated at 3,300.

Missions.—Roman Catholic missions are established, and the few children there are attend the religious schools established at Rikitea, where also the administrator and two gens d'armes, the only Government officials, are stationed.

Barrier reef.—The external form of the group conveys at once an impression of their volcanic origin, the barrier reef, nearly 40 miles in circumference, contrasting conspicuously with the principal islands. On the northeastern side of the barrier reef there are many low detached islets covered with bush and a few coconut trees. On the opposite side, the barrier reef dips from 5 to 7 fathoms below the surface, affording an entrance to the lagoon within, where in all directions live coral appears to be fast growing up. The outer side of the barrier reefs springs from a great depth, the inner side descends with a slope to very irregular depths of from 3 or 4 to 20 or 25 fathoms.

Wind and weather.—There are two well-defined seasons at these islands; one from January to June of excessive heat, the other from July to December of lower temperature during which rains occur. The first three months of the year are the hottest, with long periods of calm. In the end of March the southeast trade commences to blow and gradually increases in strength until July and August—in the latter month gales sometimes supervening and changing through south and west to northwest with rains. By the end of September the bad season is over, and the trade wind gradually decreases in strength until, toward the end of December, it dies away altogether. It is very rare that any other winds than the southeast trade wind is experienced at these islands.

Caution.—The mariner is cautioned that the charts of this locality can not be considered complete, and there are doubtless many coral heads in the lagoon not yet discovered; a careful lookout from aloft is therefore necessary.

Manga Reva or Pearl Island (lat. 23° 08′ S., long. 134° 58′ W.), the principal island of the group is situated near the center, and Mount Duff, its highest peak, rises 1,427 feet above the sea level. The other high islands are Aka-Maru or Wainwright Island, Ai-

Kena or Elson Island, Tara-Vai or Belcher Island, Aga-Kauitai, Makaroa or Marsh Island, Kemaka or Collie Island, Manui, and Maka-pu.

Manga Reva Island is about 4 miles in length, northeast and southwest, and Mount Duff, at its southeastern point, rises into two peaks in the form of wedges very conspicuous at a distance and visible about 45 miles. All the islands are steep and rugged, particularly Makaroa, 479 feet high, which at a distance resembles a ship.

The village of Rikitea is on the eastern side of Manga Reva and northeastward of Mount Duff.

Passages—Depths.—There are three passages into the lagoon: The Southeast, Southwest, and Northwest Passages, which, by attending to the following directions, may be used with safety by vessels up to 12 feet draft, the greatest draft that can safely proceed to the anchorage at Rikitea, which is the only well-sheltered anchorage among these islands.

Northwest Passage.—For entering by the Northwest Passage, between Manga Reva and Tara-Vai Islands, the leading mark is the peak of Aka Maru Island, seen midway between those two islands, bearing 123°, which leads over a depth of 3¼ fathoms, and a vessel should anchor when Mount Duff bears about 55°; or, if bound to Rikitea, proceed on the leading line given until Mount Duff bears 35°, when a beacon on Au Kena will be seen in line with a belvedere on the southwest point of that island, which, kept in line on an 85° bearing, leads between some coral reefs, but over the Brisant Bank a patch of 2½ fathoms; therefore a vessel of 12 feet draft or upward can not follow this line, but keeping more to the southward should leave this and other banks on the port hand, conning the ship from the masthead, until the beacons on the eastern side of Manga Reva are seen in line, which mark leads between the extremes of the reefs into Port Rikitea.

Southeast Passage.—This is the best passage by which to enter; it lies on the southeastern side of the group, southward of all the coral islands, and with Mount Duff bearing 328° in line with the southwestern point of Maka-pu Island, off the southern end of Aka Maru. With these marks, steer over the Barrier Reef, on which there is at this part 6 fathoms water, and thence in from 5½ to 10 fathoms to pass close to the southern extreme of Maka-pu Island; then keeping a lookout at the masthead and a boat ahead in order to avoid the numerous reefs off the southeast point of Manga Reva; proceed at slow speed or under easy sail for the anchorage southward of Mount Duff, or for the anchorage of Rikitea, if required, and if not more than 12 feet draft.

Southwest Passage.—This is the best passage by which to quit the anchorage near Mount Duff under sail with a good breeze.

Bring the eastern bluffs of Manga Reva Island in line 35° and then steer 215° keeping this mark on, which leads over the Barrier Reef in 6 fathoms.

Although this channel lies to leeward of the group, there is generally a very heavy swell on the Barrier Reef, the sea often breaking on it in 4 fathoms; and it is not advisable to attempt the passage in light winds, for there being no anchorage ground outside, and no bottom at 80 fathoms within 40 yards of the breakers, the swell and current might drift a vessel on a shallow part of the reef on either side of the channel, which would mean instant destruction.

Anchorages—Water.—The anchorage under Mount Duff is the most convenient for watering. Here a ship will be abreast of two streams of good water, but there is some difficulty in procuring it, on account of the coral ledges which surround the island. The best water may be had on the southern side of Au Kena, where there is no surf, but the Mount Duff Anchorage appears to be on the whole the most convenient.

A fair temporary anchorage is recommended for large vessels, well sheltered from southeasterly wind and sea, the space just inside the outer bar of the northwest Passage, under cover of Tara Vai, in 7 or 8 fathoms. There are many other anchorages to which the pearl schooners from Tahiti resort, but in the present imperfectly surveyed condition of the group it is impossible even to indicate them.

Pilotage.—Many natives can be found with a very good knowledge of the position of reefs, etc., but none with sufficient capacity or nerve to be intrusted with the pilotage of even the smallest vessel.

Port Rikitea.—Opposite the southeastern point of Manga Reva is a channel about 200 yards wide, between the fringing reef and the end of a long narrow reef projecting from the western end of Au Kena. This channel leads into the outer port of Rikitea, which is large enough to accommodate a number of vessels.

Beacons.—The extreme of the reef projecting from the western end of Au Kena is marked by a beacon of 2¾-inch pipe. The two beacons on the middle of the eastern side of Manga Reva, in line, 351°, lead between the extremes of the reefs.

Depths.—From the fringing reef which forms the western side of the outer port, the depth increases to 25 fathoms, and then shoals toward the coral heads and banks which form the eastern side.

Outer Anchorage.—The bottom is mud and coral, and the depth rather great for anchoring; the holding ground also is not always good, depending on the even surface or otherwise of the bottom, the depths being very irregular, and the anchorage unsuited for vessels drawing over 12 feet.

Slack water should be chosen for entering, as at certain times of tide the current is strong and variable, and the width, in places, is not more than about 50 yards.

Inner Anchorage.—The inner port of Rikitea is perfectly secure, but can only be entered by short vessels up to 12 feet draft. The channel through the reefs from the outer port is closely buoyed and beaconed, but most difficult, and not to be attempted without accurate knowledge. The space within, close to the shore, is very confined.

Tides.—It is high water, full and change, at 2h. 30m.; springs rise 4 feet.

Morane or Cadmus Island (lat. 23° 08′ S., long. 137° 08′ W.), about 115 miles westward of Manga Reva, is a low coral atoll, 5 miles long by 2½ miles broad, without any entrance to the lagoon, in which are three low islands inhabited by about a dozen natives who cultivate a few coconut trees.

Moerenhout or Maria Island (lat. 22° 00′ S., long. 136° 12′ W.), lies 94 miles northwestward of Manga Reva. It was discovered by the ship *Amphitrite* in 1832, and is low and wooded, having a lagoon in the center without any pass through the reef.

Marutea or Lord Hood Island (lat. 21° 31′ S., long. 135° 38′ W.), was discovered in 1791. It is a cluster of small islets rising from a chain of coral even with or a little above the water level. On these islets grow a variety of shrubs and trees. The atoll is 11 miles long and 4¾ miles wide, in a north and south direction, and incloses a lagoon into which there is no entrance. It is not inhabited, but is frequently visited by the natives of Manga Reva for pearl shell, which is abundant.

Actæon Group.—The nearest island of this group is about 40 miles westward of Marutea. The group consists of four islands, and was discovered in 1833.

Maturei Vavao or Melbourne Island (lat. 21° 25′ S., long. 136° 25′ W.), the southeasternmost and largest is about 6 miles long northwest and southeast, and wooded except on the western side. Pearl fishermen have several times attempted to establish themselves here, but have been compelled to abandon the place, the sea washing all over it in bad weather. There is no pass into the lagoon.

Tenarunga or Minto Island (lat. 21° 18′ S., long. 136° 31′ W.), another atoll, lies about 8 miles northwestward of Maturei Vavao; it is much smaller than the latter, and, like it, is very low but wooded, and without a pass through to the lagoon; it is without permanent inhabitants.

Vahanga or Bedford Island (lat. 21° 15′ S., long. 136° 36′ W.), lies about 5 miles westward of Tenarunga, is about 2 miles in extent in each direction, without any pass into the lagoon, wooded, and uninhabited.

Tenararo Island (lat. 21° 18′ S., long. 136° 45′ W.), the smallest of the group, lies 5 or 6 miles westward of Vahanga; it also is wooded, has no pass into the lagoon, and is not inhabited.

Current.—The current in the neighborhood of these islands, with a light westerly wind, was found to set 7 miles in 24 hours; but the direction varies with the wind, and it usually sets westward.

Fangataufa or Cockburn Island (lat. 22° 12′ S., long. 138° 42′ W.) was discovered by Beechey in 1826. It is a small atoll 3¾ miles in length by 3 miles in width. Its form is nearly oblong, with the southern side much curved. The lagoon is deep, the boundary reef very low and narrow, and in places the sea overflows, but there is no pass into the lagoon. It is uninhabited.

Mururoa or Osnaburg Island (lat. 21° 50′ 00″ S., long. 138° 56′ 30″ W.), about 20 miles north by west of Fangataufa, was discovered in 1767.

According to a survey by French officers in 1881, Mururoa is an atoll about 15 miles long eastnortheast and opposite direction by 8 miles wide; on the reef inclosing the lagoon is a chain of 18 islands with generally but very narrow openings between them except on the northwestern side. Most of the islands are wooded, especially the more eastern ones, and large plantations of coconut trees have been made by a company to whom the islands were assigned in 1876. There are no outlying dangers, and the greatest extension of the reef from the islands is about 400 yards on the eastern side and 200 yards on the western side. It is reported that the soil of the islands is fast being washed away.

Village.—The village is on the western or inner side of the eastern island.

Passes.—There are two passes into the lagoon, both on the northwestern side; they are on either side of a low barren islet, the reef bordering the other side of each pass being awash. From the islet, reef extends about 400 yards eastward, but only about half a cable westward. The eastern pass is considered the widest and best; both are very short and have about 12 feet of water, but before attempting either, a stranger should examine them from a boat.

Caution.—The heavy surf on the shore forces the sea over the reef into the lagoon at many places, except at low water, and occasions a constant but not very strong outset through the channel to leeward. The lagoon must be navigated by the eye from aloft, as, although there are general depths of 20 fathoms, it is dotted with knolls of coral, in some cases so close to the surface as to be dangerous even to boats sailing with a fresh breeze, especially in cloudy weather, when they are difficult to distinguish.

Anchorage.—The holding ground inside the lagoon is not good, and northwesterly winds throw in a troublesome sea.

Tematangi or Bligh Island (lat. 21° 38′ S., long. 140° 40′ W.), 90 miles westward of Mururoa, was discovered in 1792 and named Lagoon Island. The atoll is about 7 miles in diameter.

The natives in former days were strongly suspected of cannabalism. The island is at present uninhabited.

The eastern side of the atoll for about 6 miles is wooded without a break; the northwestern side also for 4 or 5 miles, but here the trees are more in groves or clumps. Off the northwest point are some large blocks of coral over which the sea breaks furiously.

There is no pass into the lagoon, but, with easterly winds, landing is fairly easy and safe on the western side at a sort of natural causeway connecting two wooded islands; landing can also be effected on the northern side of the reef.

Tureia (lat. 20° 45′ S., long. 138° 30′ W.), also known as Papakena or Carysfort Island, 60 miles northward of Mururoa, was discovered by the British naval vessel *Pandora* in 1791. The atoll is about 5 miles in diameter, very low, well wooded except on the southeastern side, and has no pass into the inclosed lagoon. There are less than 20 inhabitants.

Vana Vana (lat. 20° 45′ S., long. 139° 10′ W.), also known as Kurateke or Barrow Island, 32 miles westward of Tureia, was discovered by Beechey in 1826. The atoll consists of a narrow strip of land about 200 yards wide surrounding a lagoon 1¾ miles in length north and south, and about 1¼ miles wide, into which there is no pass, and in which the color of the water indicates no great depth.

On the shore of the lagoon, the pandanus, coconut trees, and bushes constitute a thick wood. Under the trees three large pits were found containing fresh water. In 1861 there were a few inhabitants, and it is still reported to be inhabited.

Duke of Gloucester Islands consist of a small group of three atolls, which were so named by Carteret in 1767.

Nukutipipi or Margaret Island (lat. 20° 42′ S., long. 143° 5′ W.), the easternmost of the group, is a small round lagoon island about 2 miles in circumference, high and well wooded on the northern side, with a flat submerged reef on the eastern side, but no pass.

Anu Anurunga (lat. 20° 38′ S., long. 143° 19′ W.), also known as Coronados or Four Crowns, from the four islands on the atoll, lies 13 miles westward of Nukutipipi, and was discovered by Quiros in 1606. There are five clumps of trees on the islands, but no entrance to the lagoon; landing is impossible, and there are no inhabitants.

Anu Anuraro (lat. 20° 29′ S., long. 143° 33′ W.), 14 miles west-northwestward of Anu Anurunga, was named Archangel Island by

Quiros in 1606; its true position and character were determined by the United States exploring expedition in 1841.

It is a small atoll of oblong shape, lying northwest and southeast, wooded on the eastern side only, with stunted trees in clumps. A reef extends off the northwest and southwest sides, on which there is a heavy surf, and there is a submerged reef on the south and west sides; on the western side, soundings of 15 to 20 fathoms extend at one part for about 400 yards from the reef, and here, with easterly winds, a vessel might temporarily anchor.

There is one small boat entrance to the lagoon on the northwestern side, and landing may be effected in this part in fine weather without danger.

Hereheretue or San Pablo (lat. 19° 52′ S., long. 145° 00′ W.) was discovered by Quiros in 1606, and was examined by the officers of the United States exploring vessel *Porpoise* in 1841. The atoll is thickly wooded and incloses a lagoon about 3 miles in diameter with no entrance.

Landing is fairly easy on the northwestern side during southeasterly winds, but with other winds it is very difficult anywhere. There are coconut trees, plenty of fowls and fish, but no pearl shell. The village, containing a dozen or so of inhabitants, is behind a grove of trees near the western point; the natives seldom venture outside the reef in their canoes.

Reao or Clermont-Tonnerre Island (lat. 18° 34′ S., long. 136° 20′ W.) was discovered in 1822. The atoll is 10 or 11 miles long, west-northwest and opposite direction, and very narrow, particularly at the extremes, and when seen at a distance, end on, does not appear more than ½ mile wide. With the exception of a few breaks on the southern shore, the land is almost continuous and covered with bush. At the extremes and angles the soil is higher than in other parts and has both shrubs and coconut trees, which can be seen from a ship 15 or 16 miles distant.

The inclosed lagoon is without any entrance, and contains several small islets; the shores all around are steep. It is inhabited; the village, where is the best landing, being at the northwest point; the houses stand in a row along the short and conspicuous among them is a stone church with a roof thatched with pandanus. The people, about 150 in number, profess Roman Catholicism.

Beacon.—A white stone pyramid, 16 to 20 feet high, surmounted by a mast, has been erected on the northwest point; the French flag is hoisted on this mast on a vessel making signals.

Pukaruha or Serle Island (lat. 18° 22′ S., long. 136° 58′ W.), 30 miles westward of Reao, was discovered in 1797. The atoll is of coral formation, 7½ miles in length, northwest and southeast, and 2¼ miles wide near the southeastern end but narrower at the other end, and wooded on the northeastern side.

The southwestern side differs from the rest in having a low barren flat, extending fully 300 yards seaward beyond any vegetation; on this account it is necessary to be cautious when approaching at night, as the land is so low that the breakers would be the first warning of danger.

The southern part of this island appears as a series of wooded clusters, and may by this be distinguished from Reao, which presents an unbroken line.

The lagoon is very narrow and apparently shallow, with no entrance to it, and with several islands in the middle; there are about 20 inhabitants.

Tatakoto or Clerke Island (lat. 17° 18′ S., long. 138° 19′ W.), 90 miles northwestward of Pukaruha, was discovered in 1774. The atoll is 4 miles in length east by north and opposite direction, and 1 mile broad; the land is very low and incloses a lagoon, into which there is no entrance. The northwestern part is wooded; here there is a small village and coconut trees are abundant; there is also a little brushwood at the southeastern part, but the southern part is merely reef.

Pinaki or Whitsunday Island (lat. 19° 24′ S., long. 138° 43′ W.), was discovered in 1767. The atoll is 1½ miles in diameter, steep-to all around, of coral formation, and incloses a lagoon. On the northwestern side of the atoll are three large, well-wooded islets, and the principal village is on the northern islet. The general height of the soil is 6 feet above the sea; from the trees to the surf there is a space of hard rock nearly 150 yards wide, covered with about 1 foot of water, beyond which the reef descends rapidly, and at 500 yards distant from it no bottom was found with 250 fathoms of line.

The southeastern side is very dangerous at night, the reef being bare of vegetation and but little above water.

The trees are similar to those at Reao, consisting principally of pandanus and coconut. From them to the lagoon is a gentle declivity of muddy sand.

On the southern side there is a very narrow entrance to the lagoon too shallow for the passage of boats even with a smooth sea.

Nukutavake or Queen Charlotte Island (lat. 19° 17′ S., long. 138° 49′ W.), 8 miles northwest of Pinaki, was discovered in 1767; it is about 5 miles long northeast and southwest, wooded except at its eastern end, is of coral formation, but has no lagoon.

It has about 20 native inhabitants.

Vairaatea or Egmont Island, 22 miles westward of Nukutavake, was discovered in 1767; it consists of two islands on the same reef, the eastern one being named Puka Runga and the western Puka Raro—runga signifying windward and raro leeward.

The islands are well wooded with coconut and pandanus trees. Landing is very difficult and dangerous on account of the heavy swell.

There are about 30 inhabitants on the two islands.

Vahitahi or Cook Lagoon Island (lat. 18° 42′ S., long. 138° 50′ W.), 33 miles northward of Nukutavake, was discovered in 1768. The atoll is 3 miles in length, west and east, and about 1 mile wide; the southern side is a low reef.

There are large clumps of coconut and other trees on the western part, but the eastern end is not wooded. The inclosed lagoon has no pass into it, is in some parts very shallow and contracted, and contains many islets. The shore is steep-to except on the southern side, which should not be approached within 500 yards.

The natives now number about 30.

Akiaki or Thrum Cap Island, 23 miles northwest by west from Vahitahi, was discovered in 1768 and called Des Lanciers.

It is of coral formation ¾ mile in diameter, has no coconut trees, but is otherwise well wooded except on the eastern side, and is steep-to all around. At 1 mile distant no bottom was found with 400 fathoms of line. The island is higher than any others of the Tuamotu group and has no lagoon. Landing is very difficult, and there are reported to be about 20 native inhabitants.

Ahunui or Byam Martin Island (lat. 19° 37′ S., long. 140° 25′ W.) was discovered in 1826. The atoll is of oval form, about 3¾ miles in diameter, of coral formation, and has a lagoon into which there is no pass.

The firewood here, being hard as lignum vitæ, burns a long time and gives great heat. The island is reported to be without population.

Paraoa or Gloucester Island (lat. 19° 08′ S., long. 140° 40′ W.) was discovered in 1767; it lies 32 miles northwestward of Ahunui.

It is wooded, without any pass into its lagoon, and without inhabitants.

In passing to windward of the island the current sets strongly upon it.

Manuhangi or Cumberland Island (lat. 19° 12′ S., long. 141° 16′ W.), 30 miles westward of Paraoa, was discovered in 1767. It is described as being 6 miles long and 1¼ miles broad. It is wooded except on the southwestern side, but is without a pass and uninhabited.

Nengonengo or Prince William Henry Island (lat. 18° 46′ S., long. 141° 45′ W.) was discovered in 1765. The atoll is about 6 miles wide and nearly circular.

The southern part is bare reef on the southeastern and western sides, with a coconut grove on the southern end. The southern side of the northern part is bare reef with some high clumps of trees on the eastern side.

There is a good passage into the lagoon on the eastern side about 4 miles northward of the southern point of the atoll. This entrance is about 100 yards wide and is said to have a depth of 6 fathoms.

The anchorage is good on either side of the pass, and the lagoon is reported to abound in pearl shell and pearl oysters, in which black pearls are found. Landing is fairly easy on the lee side of the atoll, but there are no inhabitants.

Hao (lat. 18° 04′ S., long. 140° 59′ W.), also known as Harpe or Bow Island, was discovered in 1768. Its figure on paper is very irregular and bears but small resemblance to the weapon after which it was named.

Aspect.—It is of coral formation, 30 miles long, and has an average width of 5 miles and an extreme width of 9 miles. The reef has on it a number of little islands, on most of which there is brushwood, especially on the weather side, but very little on the other, and so low is the reef in this latter half that the sea in places washes into the lagoon. There are several groves of coconut trees in the eastern and northern part.

This island was visited by the hurricane of January, 1903, which destroyed great quantities of brushwood and trees, which fact, having probably reduced its distance of visibility, should be remembered when in its vicinity.

Lagoon entrance.—The only pass into the lagoon is about the middle of the northern end, and by this the British naval vessel *Blossom* entered, but, though practicable for vessels of 15 feet draft, it is sometimes dangerous for boats in consequence of the overfalls, especially a short time after high water. This pass is easily recognized when coming from the northward by the wide break in the reef and by two fine coconut groves and several houses. There is good landing for boats inside the western entrance point.

The best time to enter is at high water slack, as the velocity of the ebb often prevents a ship from steering. It is at all times a difficult place to enter with a vessel drawing over 15 feet, and can not be entered against the ebb in a sailing vessel without a breeze which would command a speed of at least 6 knots, as the current runs above 4 knots.

Approaching the entrance from seaward the state of the current can generally be pretty fairly estimated by the "tailrace," which sweeps to sea for about ¾ mile; directly this slackens or ceases the entrance may be approached; it is, however, very narrow, and is further contracted by two coral knolls in the center, covered by only

16 feet water, and by the reefs extending far into the channel from both sides, especially from the eastern side, so that, although the reefs above water are 200 yards apart, the inner part of the navigable channel is only 80 or 90 feet wide. The trade wind also does not always allow a ship to lie well through.

Anchorage.—The lagoon is full of coral heads and a vessel has to be navigated by the eye from aloft. The *Blossom* anchored in the northeastern part of the lagoon in 10 fathoms, on a broad patch of sand, about 500 yards from the shore. The usual anchorage now is off the village about 6 miles east-southeastward of the lagoon entrance; the position is indicated by the village church.

Inhabitants.—The inhabitants are friendly and numbered about 400 in 1894.

Supplies consisting of fish and a few fowls and pigs are obtainable, and water of inferior quality may be obtained by digging wells. The pearl oyster is found in the lagoon.

Tides.—It is high water, full and change, at 2h. 40m.; springs rise about 3 feet.

Amanu or Moller Island (lat. 17° 40′ S., long. 140° 39′ W.), which lies northeastward of the northern end of Hao Island and is separated from it by a channel 9 miles wide, was discovered in 1829.

The atoll is 18 miles long northeast and southwest and 8 or 9 miles wide. The northwestern and southeastern sides are not wooded. At the northeastern end are some fine groves of coconut trees, and at the southwestern end are pandanus and coconut trees.

There is a boat entrance through the reef some miles westward of the northern extreme of the atoll, but the principal pass available for schooners is well down toward the southern end on the western side where the southern wooded part ceases. The pass is free from dangers and the stream is not strong, but the wind requires to be well northward of 99° for a vessel to lie through it. When in the lagoon careful steering is required to avoid the coral heads.

The anchorage is about 300 yards eastward of the village.

The village is on the southern side of the principal pass; it contains about 60 or 70 inhabitants. The natives are friendly, and pearl oysters are said to be abundant.

Tidal streams.—Outside the pass, the tide runs to the northward on the flood, and to the southward on the ebb.

Marokau and Ravahere or Dawahaidi were discovered in 1773 and called the Two groups. They are very low, and each incloses a lagoon.

They are separated by a narrow channel, in which, however, there is room for the largest ship to work, but the current running strongly through it frequently causes heavy overfalls dangerous to small sailing vessels.

Ravahere (lat. 18° 18′ S., long. 142° 12′ W.) is about 10 miles long north by west and opposite direction and not half that width. On the eastern side several parts of the reef are sufficiently high to sustain clumps of brushwood of some little height, but on the western side of the reef, where above water, is quite bare. There is no pass into the lagoon and no inhabitants. The southeastern point affords the best landing, but under the best conditions it is always dangerous.

Shoals.—The master of the schooner *Croix du Sud* reported in 1905 that two rocky patches, with estimated depths of from 5 to 6 fathoms over them, have been seen at a distance of about 8 miles eastward of Ravahere Island. These two patches are about 300 yards apart in a north and south direction from each other.

Marokau (lat. 18° 05′ S., long. 142° 15′ W.) is wooded for its whole length, nearly 10 miles, along the northern side, and there are two islands on the eastern side of the reef near the southern end between which is a pass into the lagoon available in fine weather for small craft.

But the best place for communication is on the northern side, near the northeast point of the atoll, where stands a village of about 120 inhabitants.

Here is a cutting through the reef protected by a pier of rough stones, which affords a fairly protected landing place for boats in all easterly or southerly winds, but with the wind from the northward it is not to be approached.

A vessel hove-to off this landing must be cautious, as the current has been found to set toward the reef.

The hurricane of January, 1903, completely destroyed the village, which has, however, been rebuilt.

Reitoru or Bird Island (lat. 17° 48′ S., long. 143° 07′ W.,) was discovered April 7, 1769. It is small, low, covered with brushwood on its northern side, incloses a lagoon, and is resorted to by birds in large numbers for incubation. There are no inhabitants and there is no pass into the lagoon, but it is reported that pearl shell has been found here.

Haraiki (lat. 17° 29′ S., long. 143° 31′ W.), also called St. Quentin or Croker Island, 32 miles northwestward of Reitoru, was discovered in 1772.

The atoll is about 4 miles long northwest and southeast, is rather higher than usual, and well wooded on its northern side.

It has a small but good entrance to the lagoon on its southwestern side, fit for small craft; and good anchorage among coral patches, when inside, northward of the pass. The island is uninhabited.

Hikueru or Melville Island (lat. 17° 35′ S., long. 142° 41′ W.) was discovered on April 6, 1769, and called Bird Island.

The atoll is about 7 miles long east and west, well wooded, except on the eastern and southeastern sides, which are bare, and incloses a lagoon extremely rich in pearl shell.

A village has been erected on the southwestern side of the atoll, and it has been made the official residence of the administrator of a district.

The hurricane of January, 1903, completely destroyed the village, which has since been rebuilt.

Landing is effected in a break in the reef in front of the village, but it is always difficult, and with northerly winds impossible.

Beacon.—A white stone pyramid beacon has been erected at a quarter of the length of the village from its eastern end; it is surmounted by a flagstaff from which the French flag is hoisted when a vessel is sighted.

Light.—A fixed white light, elevated 42 feet above high water and visible 7 miles, has been established on a mast, 39 feet high, erected at the landing place of the village of Tugapati. This light is only exhibited when a vessel is in sight.

Tekokoto or Doubtful Island (lat. 17° 20′ S., long. 142° 37′ W.), 16 miles north of Hikueru, was discovered in 1773.

It is a circular reef 1 mile in diameter. On the western side, landing may be effected in a break in the rocks. Great numbers of birds resort to this island. The lagoon is very shallow.

The northern half of this atoll is about 6 or 7 feet high, and the southern half is almost entirely under water with the exception of an islet situated about the middle, which is covered with high trees.

There are no coconut trees on this atoll.

Taueri (lat. 17° 23′ S., long. 141° 30′ W.), also known as Resolution or St. Simon Island, was discovered in 1772. The atoll is about 4½ miles in diameter and comprises two small islets, on which are many coconut trees, but the greater portion of the southern and western sides are bare reef.

There are several canoe passages into the inclosed lagoon on the northwestern side, difficult of access at low water; the inhabitants are few and friendly. No pearl shell is found here.

Rekareka or Good Hope Island (lat. 16° 51′ S., long. 141° 55′ W.) lies 38 miles northwestward of Taueri. The atoll is about 4 or 5 miles in circumference. There is a boat entrance to the lagoon on the northeastern side. The island is well wooded, but least so on its southern side, and inhabited by a few friendly natives, whose small village is at the southwest point, where is also the best landing.

Marutea or Furneaux Islands (lat. 16° 54′ S., long. 143° 20′ W.) is an atoll discovered in 1773 and is one of the most dangerous in the archipelago.

It is about 20 miles long east and west and has an extreme width of about 10 miles. On the southwestern side the encircling reef is completely submerged, and on the northeastern side there are only a few places where the reef is sufficiently above water to support a few small clumps of trees.

At the northeastern extreme there is a pass into the lagoon practicable for small craft, but difficult of access; the place is marked by a single islet thickly wooded; the stream is always running out through this pass.

The best place for landing is in front of the last island on the northwest side of the atoll, where there are a few huts, but no permanent inhabitants.

Nihiru or Nigeri Atoll (lat. 16° 41′ S., long. 142° 53′ W.) is nearly circular, about 7 miles in diameter, well wooded at its northern extreme, fairly so along its northeastern side and at its southeastern point, but between the south and southeast points there are only a few scrubby bushes. The reef extends a considerable distance from the south and southeastern points, but forms a deep bight just westward of the latter.

There is no pass into the lagoon and no permanent inhabitants. The best landing place on the reef is in a large bay formed on the western side of the atoll.

A strong northeasterly current was experienced around the southeastern point by the French naval vessel *Mésange* in 1874.

Fakahina or Predpriatie (Enterprise) Atoll (lat. 15° 59′ S.. long. 140° 09′ W.) was discovered in 1824. It is 4 miles in extent east by north and west by south, well wooded with palm trees, incloses a lagoon, and is seen farther than most of these islands.

It has about 150 inhabitants, all Roman Catholics, and entirely under the authority and government of the missionaries. The village is neatly built and kept and stands on the northeastern side of the island.

There is no pass into the lagoon and landing is not practicable at the village. The best and, indeed, the only safe landing is on the southwestern side at a place marked by three houses and a flagstaff; from thence those landing cross over the lagoon in boats to the village. Schooners embark cargoes of copra at this landing place.

Water is better at this than at most of the islands, but from the nature of the shore it is very difficult to obtain for ship use.

Angatau or Arakcheff Atoll (lat. 15° 51′ S., long. 140° 50′ W.), 39 miles westward of Fakahina, was discovered in 1820. It is wooded throughout, and in some places by trees of large growth, but there are very few coconut trees.

There is no pass into the lagoon; landing is effected near the western point, where the village, containing about 120 inhabitants, stands.

It is, however, difficult and dangerous, though the natives are always ready to lend a hand; with the wind northward of east by south, landing is easier on the southern coast.

There are Roman Catholic missionaries, a church, and a school on this island, but the people have as yet made but little progress from the savage state.

Puka Puka (lat. 14° 50′ S., long. 138° 50′ W.), also called Honden or Dog Island, was discovered in 1616. It is an atoll inclosing a lagoon which communicates with the sea at very high tides only by means of two channels, which are never navigable passes, on opposite sides of the island.

The soil is deeper on this island than on most of them, and a variety of walnut tree is found, but there are no coconut trees, and no inhabitants.

Napuka and Tetopoto Islands.—These islands were discovered in June, 1765, and named the Disappointment Islands. They are 100 miles distant from any other islands of the archipelago.

Napuka (lat. 14° 09′ S., long. 141° 14′ W.) is a series of islets connected by coral reef of irregular form, inclosing a lagoon without any entrance pass to it; within the lagoon are many knolls about 4 or 5 feet above water.

The eastern and western sides are well wooded, the vegetation differing considerably from other islands of the archipelago. There are, however, a few coconut, bread fruit, and pandanus trees, but the southern side is almost entirely devoid of vegetation.

The landing place for Napuka Island is ½ mile from the west point of the island either on the north or south side of the point, according to the state of the sea.

There is a landing place about 1 mile from the western point in front of the village, a mere collection of huts hidden behind the trees, but a flagstaff and the canoes on the shore may be seen. If there is any swell, landing is only possible in the native canoes.

The hurricane of January, 1903, completely destroyed the village, which has, however, been rebuilt.

This island is the most isolated and probably the most backward of the whole archipelago. The inhabitants, about 50 in number and nominally Catholics, are apparently of a distinct and inferior race, and but little removed from perfect savagery. They live on the fruit of the pandanus and on other naturally grown vegetable matter and go entirely naked.

Tetopoto or Otooho (lat. 14° 06′ S., long. 141° 23′ W.) is about 12 miles northwest by west from Napuka, from which it is visible. The island is thickly wooded with large trees and is about 1 square mile in extent, having no lagoon, and, though a few natives have been found on it, probably is not permanently inhabited. Many turtle are seen in this vicinity.

Takume or Wolkonski Atoll (lat. 15° 44′ S., long. 142° 09′ W.), discovered in 1820, is about 14 miles long north and south, but only about 4 miles wide.

It incloses a lagoon into which there is no pass, though about 3 miles from the northern point on the northwestern side there is a break in the reef which looks like one, but it can only be used by small boats, and is the best landing place. The northern end is thickly wooded with coconuts, and it is very generally wooded all around, except on the southeastern side, where the islets only are wooded, the atoll being in that quarter partly submerged.

There is a large village named Takume at the western point; it is only possible to land on the reef near the village with winds between south and west.

The current runs sharply past this point and causes a heavy sea.

Raroia or Barclay Island (lat. 16° 01′ S., long. 142° 27′ W.) is an atoll discovered in 1820; it is about 21 miles long in a northeast by north and opposite direction, and has an extreme width of about 8 miles.

It is lightly wooded on the eastern side, but the northern and western sides are covered with vegetation, especially about 1 mile southward of the west pass; but at the southwestern point, where clumps of coconut trees formerly stood, there is now only brushwood and pandanus trees.

The village is on the western side of the atoll, ½ mile southwestward of the pass, where a church and a large house are conspicuous from the offing. The village has about 100 inhabitants, some Catholics and some Mormons.

A jetty, at first perpendicular to the shore and then parallel with it, in front of the village, gives access and good shelter, with the usual easterly winds, to a few small schooners and boats.

Ngaruae Pass.—The shoals in this pass divide it into three channels, the northern being clear, with a depth of about 5 fathoms in the fairway; the others are only available for small craft; large vessels should not enter without a native pilot.

Since the hurricane of 1906, a bank of sand and coral has been found to extend southwestward from the reef off North Point.

The village of Ngarumaova, where there is a boat harbor, is situated nearly 2 miles southwestward of the pass.

Directions.—When within the entrance of the northern channel and clear of North Teharato Bank, a large vessel should steer to pass westward of Napiropiro Reef on which there is a remarkable black rock, nearly always visible; and then between Nakatika and Opararari Reefs, when steer for the coast reef passing between it and the offlying clusters of reefs, Temarie and Teu, and on either side of Kurataketake Reef to the anchorage off Ngarumaova.

Anchorage.—Large vessels should anchor, in a depth of 15 fathoms, sand and shells, with the church bearing 267° and Neketautaù reef bearing 347°.

The best anchorage for vessels of less than 15 feet draft is at 200 yards eastward of the wharf, where they should moor. There is a coral head with 15 feet water on it with the north point of the largest isolated reef eastward of this anchorage bearing 88° distant 300 yards.

Tides.—It is high water, full and change, at Raroia at 6h. 0m.; springs rise about 1¾ feet; slack water in the pass is of short duration.

Supplies.—Pigs, fowls, fish, and water can be obtained.

Current.—A strong current usually runs to the westward between Takume and Raroia, and with the wind between northeast and southeast there is a heavy sea in this channel.

Taenga (lat. 16° 20′ S., long. 143° 11′ W.), also known as Holt or Yermalov Island, is a very low atoll, about 11 miles long east and west and 6 miles wide in the middle.

It incloses a lagoon with which there is communication by two passes—a small one on the northeastern side; the other, about 1½ miles from the southern point on the southwestern side, admits vessels of 200 tons, and is about 40 yards wide and nearly 600 yards long—before it opens out into the lagoon, where it is divided into two channels by a small coral head which dries at low water.

As the pass lies southwest and northeast the wind is often too scant to sail in, and in such a case a vessel is often tracked in by the natives. A pilot should always be obtained.

The northern side of the atoll is well wooded; a great part of the southern side is awash and there are only two small clumps of coconut trees—one on either side of the pass. It is reported that the eastern point of this island is charted several miles too far eastward.

The point is bare of trees and should be approached with caution, especially at night.

The village is a poor collection of huts on the southern side of the pass, and the inhabitants, about 100 in number, are by no means a fixed population.

Makemo or Philip Island (lat. 16° 36′ S., long. 143° 33′ W.) has a total population of about 220, most of whom are excellent divers; it was discovered by the ship *Margaret* in 1803.

The atoll lies in a northwest by west and opposite direction, is about 40 miles in length, 8 to 10 miles wide, very low, and incloses a lagoon. The whole of the northeastern side is well wooded, the southern side is generally about the water level and bare.

There are two entrances to the lagoon, one on the northeastern side, named the Puheva Pass, about 10 miles from the eastern end; the other, called the Vahinatika Pass, at the western end.

From both of these, with winds between south and southeast, the current sometimes runs out, it is said, at the rate of 8 or 9 knots.

Puheva Pass.—The Puheva Pass is easily recognized by the break in the wooded reef and by the flagstaff at the village on the starboard hand in entering; it is clean, deep, 300 yards wide, and may be taken by any vessel; slack water only lasts a few minutes, and the flood stream runs up to the time of high water. Immediately inside, the channel is divided into three, by two coral banks, and again either of these may be chosen according to the wind, but for a steamer the central one should be preferred, and she should anchor about 400 yards westward of the Tuteakiore Bank, having left that and the Rikiriki Bank on the starboard hand in passing. In rounding the Rikiriki Bank, especially at its southern end, care should be taken to give it a wide enough berth.

Beacon.—A beacon of iron rods with cylindrical topmark was erected at the southeast end of the reef on the west side of the Puheva Channel; it may be washed away, and is not thoroughly reliable.

The anchorage is good in 7 fathoms, sand and coral, about 400 yards southwest by south of the wharf and abreast of the village of Puheva, which is the seat of government of the district. The holding ground is indifferent.

Vahinatika Pass, so named from a village 8 miles from it on the northern side, may be taken by vessels up to 16 feet draft; like the other pass, it is divided into three channels inside by the interposition of two coral banks.

Although there are many coral banks and heads in the lagoon, vessels may pass from one village to the other, and even work to windward, it being only necessary to keep a good lookout from aloft.

Anchorage.—There is good anchorage in the lagoon off the mole in 7 or 8 fathoms, about 400 yards from the shore. The *Mésange* entered the lagoon by the Puheva Pass, visited and anchored off each village, and left by the Vahinatika Pass.

The village of Vahinatika is 15 miles westward of Puheva.

Pigs, fowls, and good water may be obtained.

Tides.—It is high water, full and change, in the Puheva Pass at 3 hours.

Caution.—In addition to the strong currents caused by southerly winds, as before stated, the ebb tide frequently sets out through the passes with great strength; vessels under sail should, therefore, not attempt to enter except on the flood tide, without first acquiring a knowledge of the state of the stream in the pass.

Katiu or Saken Island (lat. 16° 22′ S., long. 144° 28′ W.) is an atoll discovered in 1822; it is very low, not wooded on its southern or southwestern sides, but in other parts covered with brushwood and occasional groves of coconut trees.

The atoll incloses a lagoon into which there are two passes, one, the Toini Pass, in the northeastern part near North Point, suitable for schooners, which enter and moor to a wharf in front of the village; the other pass in the southwestern part is smaller and only fit for boats.

The Toini Pass is distinctly marked by a gap in the otherwise continuous line of coconut trees. The gap is very noticeable from the offing, and serves as a landmark.

The village of Toini, with a population of about 80, is situated near the pass of that name. The atoll is about 15 miles long northwest and southeast, by half that width.

Pearl shell is found in the lagoon.

Raeffsky Islands consist of the three small atolls, Hiti, Tuanaka, and Tepoto; the last named was discovered in 1820.

Caution.—It was reported in 1880 that Katiu and the Raeffsky groups were not placed in relatively correct positions on the charts, as bearings taken from a ship gave impossible results. There is no record of any examination since that date, but French descriptions place Tuanaka, relatively to the others, 5 miles farther westward than our charts or description as below.

Hiti or Eliza Atoll (lat. 16° 42′ S., long. 144° 09′ W.), the easternmost, is uninhabited, very small, and has a lagoon without an entrance.

Tuanaka or Reid Atoll, the northernmost and largest, is thickly wooded, but uninhabited; there is a small passage into the lagoon for boats on the northern side.

Tepoto or Ofiti Atoll, the southernmost, is thickly wooded and has a boat entrance into the lagoon on the northern side; the tide runs so strongly, however, that it can only be entered on the flood. In fine weather, boats can land on the reef on the western side.

Motutunga or Adventure Atoll (lat. 17° 03′ S., long. 144° 25′ W.) was discovered in 1773. It is very low, especially on its southern side, which has no vegetation from end to end; but, on the northern side it is wooded for its whole length in clumps on the islets; it is about 8 miles long east and west and has an extreme width of 5 miles about the center.

The atoll incloses a lagoon, into which there are two passes; that near North Point is a boat passage only; the other, on the northwestern side near the western point, is used by small vessels, but can only be entered at slack water; they moor in the pass opposite the village of Marokupenga. The island is, however, only inhabited during a portion of the yer. There are coconuts; also a little pearl shell.

Tahanea or Tchitchagov Atoll (lat. 16° 51′ S., long. 144° 41′ W.), discovered in 1820, is about 25 miles long east and west, and has an extreme width of 10 miles. It is generally inhabited, the people of Katiu and of Faaite having plantations of coconuts here.

It is wooded the whole length of the northern and northeastern sides, but quite bare on the southeastern and southern sides.

Passes.—There are three passes into the lagoon on the northeastern side of the atoll, all close together.

The Otaho Pass, 6 miles from the eastern end, is shallow and only fit for small craft.

The Manino Pass, just west of the first described; is practicable for vessels, and the anchorage within is about 300 yards from an islet in the lagoon on the starboard hand in entering.

Beacon.—A coral beacon, white, with a red conical topmark, is erected on the west coast of this pass.

A shoal of 3 feet exists 1,700 yards 197°, of this beacon.

The Motupuapua Pass, just westward of the Manino, was said to be practicable and not so long, but is now reported to be dangerous. There is anchorage on either side of it within the lagoon.

As with nearly all these atolls, the lagoon is much encumbered with coral heads, with deep water between them.

Anaa or Chain Island (lat. 17° 20′ S., long. 145° 30′ W.) is an atoll discovered in 1769. It is 19 miles long northwest and southeast, and has an average width of 6 miles. It is the best cultivated, and still has the largest export trade of any island of the whole group.

It is said to have formerly contained 5,000 inhabitants, which is more than the latest account of the population of the whole archipelago. This large number was accounted for by its conquest of the other islands and enslaving their inhabitants. In 1874 the population was estimated at 1,500, but at present it is only about 700. This is no doubt owing to the disastrous hurricane of February 7, 1879, which destroyed every building in the island, including the residency, with the single exception of the Roman Catholic church, and destroyed the coconut plantations, from the cultivation of which in 1873 copra was exported to the amount of 900 tons. The island has been extensively replanted, but it is no longer the seat of government of the whole group, the resident being now stationed at Fakarava Island.

The atoll is wooded all round, and there is no entrance to the lagoon, but the shores are fairly easy of approach on the lee side.

Landing.—The best landing, and the place where trade is carried on, is at the village of Tuuhora, on the northern part of the atoll, where is the church and mission station before referred to; there are four other villages on the island.

The village and flagstaff of Tuuhora were washed away by a tidal wave in 1906. A new village is now situated ½ mile southeastward of the old one and ½ mile from the beach. Two sheds are located on the beach at the end of the road leading to the new village.

It is said that a curious effect, apparently of mirage, is produced in certain conditions of weather by this island. Its shallow lagoon projects on the clouds a beautifully clear greenish reflection of itself, which is seen at a great distance.

Faaite or Miloradowitch Island (lat. 16° 42′ S., long. 145° 22′ W.) is an atoll discovered in 1819.

It is 15 miles in length in a northwest by west and opposite direction and about 5 miles broad. At the northwestern end is an opening, easily recognized by some groups of coconut trees, several houses, and a white pyramid. Here small vessels up to 60 tons may enter and moor about 100 yards within the lagoon. The island is well wooded near the western end, and there are some clumps of trees on the northern and northeastern parts, but the southern side is merely reef and very dangerous of approach at night.

Good water is in greater abundance here than in the other islands, but difficulty to procure.

Fakarava or Wittgenstein Island was discovered in 1819. It lies in a northwest and southwest direction; the western side slightly convex, the northern, eastern, and southern sides concave toward the ocean.

The lagoon inclosed by this atoll is 32 miles long and about 10 miles wide, rectangular in form, and having three entrances, one at the northern end, the other two at the southern end. The lagoon has but few dangers and a perfectly safe channel for large vessels from one end to the other might easily be buoyed. In the southeastern angle of the lagoon is a sheltered place where a vessel might safely be careened for repairs.

Caution.—It is reported that many sorts of fish in this lagoon, or caught near the reefs, are poisonous.

On the whole southwestern side of the encircling reef are only six small islets situated about 1 mile from the outer edge of the reef, and only two, or at most three, can ever be in sight from a vessel outside the reef at one time. The northern and northwestern sides are generally well wooded and have numerous clumps of coconut trees. The eastern side and southeastern point are wooded, but the southern end only sparsely so, except in the vicinity of the Tetamanu Pass.

The hurricane of 1878 passed over this atoll and caused much damage to the trees.

Dangers.—A reef awash extends a considerable distance both from the northwestern and southwestern points of Fakarava.

Population, etc.—The total population in 1894 was estimated at about 200; of these, about 80 reside in the village of Rotoava in the northeastern angle of the lagoon, and, with the exception of the newly erected residency and a few government buildings, it is but a wretched collection of huts; about 100 also live at the village of Tetamanu at the southern end of the lagoon and on the eastern side of the pass of that name.

Passes.—Three passes lead into the lagoon, viz, the Ngaruae or North Pass; the Tetamanu, and Tumakohua, or South Pass; also a small boat pass near the southeastern point of the island, which, as it can only be used by small boats under favorable circumstances, needs no further notice.

Ngaruae or North Pass is near the center of the northern end of the atoll, and is about 1,400 yards wide, with a least depth of 6 fathoms; it is quite free from dangers, short, and suitable for large vessels; steamers commanding a speed of 8 knots can enter at any time; it is in fact the best pass in the whole of the Tuamotu Group, and although the current runs out with great strength it follows the axis of the pass. The eastern side of the entrance is bordered by a thick grove of coconut tres, and the western side by a low sandy point on which is a pole surmounted by a triangle supposed to be painted white, but so small and badly maintained as to be almost useless as a beacon.

Sailing vessels should enter or leave either during slack water or with the tide, and should keep nearest the eastern side. After entering, Poniu Reef, which dries 3 feet, should be left on the port hand, giving it a berth of about 300 yards. About 600 yards 268° of Poniu Reef, in line between it and the eastern entrance point, is a bank with only 2¾ fathoms water, and a reef barely covered at low water extends to the southward from the barrier reef nearly off to the Poniu Reef.

Dangers—Beacons.—Between Ngaruae Pass and Rotoava Anchorage, there are two coral patches which dry at low water; a third, with 7 feet water, 1½ miles west-by-south of Rotoava Pier; and a fourth with only 4 feet. These two latter are marked by beacons. The west end of Togamaitu-i-tai is marked by a white beacon.

Rotoava Anchorage (lat. 16° 02′ 30″ S., long. 145° 38′ 30″ W.) is about 5½ miles eastward of Ngaruae Pass, and the locality may be recognized by the iron support of the light on Rotoava Pier. The line between Poniu Reef and the pier is free from danger, as the shoals with beacons can all be distinctly seen and should be left on the starboard hand. Small craft anchor in from 7 to 10 fathoms, sand and coral, with the pier-end bearing northeast by north; larger vessels anchor farther westward. There are several coral reefs near the shore at the anchorage, but the two outermost, which dry 3 feet at low water, are each marked by beacons, viz, the Tapaeroa and Kopoapiro Reefs.

The anchorage is excellent in winds from west by south, through north to southeast by south. Southeasterly winds raise a slight sea, but with winds between southeast by south and west by south, the sea is heavy. The holding ground is excellent, the bottom being formed of compact white clay.

Light.—A fixed white light, elevated 29 feet above high water, and visible in clear weather from a distance of 10 miles, has been established on an iron support erected near the inner end of the pier.

Supplies.—Pigs, fowls, and eggs are procured with difficulty both at Rotoava and at Tetamanu. Fairly good water may be found at both places by digging.

Tetamanu, Tumakohua, or South Pass is a little eastward of the extreme southern point of the island. On approaching from seaward four clumps of coconut trees distinctly more prominent than others will be seen eastward of South Point; the pass is between the third and fourth of these clumps reckoning from the westward; it is deep and capable of being used by the largest vessels, but is somewhat intricate, and for such would require to be buoyed or beaconed, consequently it is not recommended for vessels drawing over 15 feet. At its inner part, it is divided into two by the interposition of a coral reef, the passage to the right of which is only fit for small craft, that to the left being the deep-water channel, though from the number of black rocks on this reef and on that extending from the barrier reef, this, the best passage, appears as seen from the seaward to be blocked by rocks.

The anchorage is northwestward of the village of Tetamanu and is approached by passing northward of two banks nearly dry; it is close to the shore in from 6 to 8 fathoms, sand and coral. It is much exposed to northwesterly winds.

Tides.—It is low water at Tetamanu about two hours before the moon's meridian passage.

Current.—In the channel eastward of Fakarava, the currents are often very strong and uncertain. In one night, in this vicinity, the French vessel *Taravao* was set 30 miles to the eastward.

Raraka (lat. 16° 04′ S., long. 144° 59′ W.).—This nearly circular atoll was discovered in 1831. It is about 14 miles in length in a northwest and southeast direction, by 11 miles in width.

The northern side is wooded, and on the southern side are seven small wooded islets, but toward the southeastern and southwestern parts the reef is very low and bare.

There is an entrance pass into the lagoon on the northwestern side, navigable for small trading craft, but the current runs out constantly and very strongly, with southeasterly winds prevailing. The small village of Matahai, with about 50 inhabitants, is situated near and on the eastern side of the pass.

Inside the lagoon facing the pass is an islet and a coral bank; and there is a narrow passage between the latter and the shore, which may, in case of necessity, be taken.

The anchorage in about 7 fathoms is beyond this bank, and it is in general necessary to make a tack to fetch it; a pilot should, however, be obtained before entering.

Kauehi or Vincennes Island (lat. 15° 50′ S., long. 145° 08′ W.) is an atoll discovered in 1835. It is 12 miles long north and south, by 9 miles wide; is very low and wooded except in the southeastern part, where there are no trees for a space of 3 or 4 miles, and this part is very dangerous to approach at night.

The pass into the lagoon is on the southern side and is 100 yards wide, leading through the reef in a northwest and southeast direction, and has 15 fathoms water.

Kauehi Pass is very difficult to recognize when coming from the southward. The groups of palm trees on the right and left are very low, and it is the high trees to the northwest of the pass which are seen first.

When the current comes out of the pass violent eddies are caused quite 600 yards outside.

The tidal streams in the pass run with considerable strength.

The lagoon is fairly clear as far as is known except near the sides, where detached patches of from 3 to 6 feet will be found, but in its navigation a good lookout should be kept from aloft for coral heads.

The anchorage is about 9 miles northward of the pass, where there is a village with about 250 inhabitants, and at about 1½ miles southward of the anchorage is the small wooded islet Tutu.

In steering for the anchorage, after clearing the pass, steer about 54°, and a rock above water will soon be seen on the port hand; when clear of it, steer for the village and leave another rock, awash, about 200° from Tutu Island, 200 yards distant on the starboard hand; afterward, another rock awash and also one which does not always break, have to be left on the port hand, and the anchorage is between this latter and the southern point of the village in 8 fathoms, sand and coral.

Taiaro or King Atoll (lat. 15° 46′ S., long. 144° 37′ W.) was discovered in 1835. It is rather higher than usual, being 45 feet to the tops of the trees, nearly circular, about 3 miles in diameter, and thickly covered with trees and shrubs, which surround a lagoon into which there is no pass. The best landing place is on the western side, near some native huts. With winds between east by south and southeast by south small craft may make fast to the reef in this part. There are no regular inhabitants, but the island is visited at certain times by the natives of Kauehi.

Aratika or Carlshoff Island (lat. 15° 33′ S., long. 145° 33′ W.) is an atoll discovered in 1722 and was named Carlshoff. It is triangular in shape; the northern end is 8 miles in length east and west, and the eastern and western sides rather longer and terminating in a point to the southward.

The whole of the northern part is thickly wooded, and the highest point is at the northwestern angle, where it is 12 feet above low water. The eastern, southern, and western parts of the reef are low and dangerous of approach at night. The island is visited at times by the people of Kauehi, but has no permanent population.

There are two entrances to the lagoon, one on the western side, the other on the eastern side. The latter is tortuous and with many rocky patches, and is only fit for small craft acquainted with the locality. The former, called the Temakota Pass, is the best. It is about 50 yards wide and 200 yards long before it opens out into the lagoon, where great care is required to avoid the numerous coral heads. In coming from the westward, the position of this pass may be known by its lying between the largest of the wooded islets on the western reef on the starboard hand, and a small clump to the northward of it on the port hand.

Caution.—The fish in Aratika lagoon are stated to be poisonous.

Toau or Elizabeth Atoll (lat. 15° 50′ S., long. 146° 03′ W.) is according to the chart about 23 miles in length in an east-southeast and opposite directions, and 11 miles wide.

The northwestern side is well wooded to within a few miles of the western point; on the southern side there is a small wooded islet about 4 miles eastward of the western point; eastward of this islet, the sea breaks continuously on the reef, which is very low and scarcely ever dry. The northeastern side is wooded at intervals; the greatest space without vegetation is just westward of the Otuni Pass. The eastern point is well wooded.

The island is only inhabited at certain seasons of the year by people from Fakarava.

Passes.—There are two passes into the lagoon, both are on the northeastern side, they are named the Orepa and Otuni passes:

Orepa (lat. 15° 51′ S., long. 145° 57′ W.), the western of the two passes, is several miles westward of the Otuni Pass, but, although it is nearly 400 yards wide, is only adapted for small vessels, and by them should not be attempted except at slack water. There is anchorage on either side inside the pass.

Otuni Pass, the easternmost, is about 3 miles from the east point of the atoll; it is wide, clean, and safe for vessels of considerable size, having from 22 to 26 feet water; there is ample room for small vessels to work in. The eddies are very strong and have been felt 4 miles outside the entrance.

The best anchorage inside is between 1,000 and 1,200 yards southward of the pass.

Matariua Anchorage or Amyot Bay, which is said to afford shelter in all winds, must be a dangerous anchorage if the wind should come from the northwest by north; it is a small horseshoe shaped bay in the outer side of the reef in the northwestern part of the atoll, and being a somewhat confined anchorage, vessels should moor and secure to the reef.

Caution.—All the fish in Toau Lagoon are said to be poisonous.

Niau or Greig Atoll (lat. 16° 07′ S., long. 146° 23′ W.) is about 4 miles in diameter, about 26 feet above the water level, well wooded, and visible for a distance of 10 or 12 miles. It is a good landfall to make when bound from Tahiti to Fakarava. The fringing reef extends a very short distance from the shore. The hurricane of 1878 devasted this island; many of the inhabitants were washed into the lagoon by the surf and drowned; a few were saved by tying themselves to trees. The lagoon was merely a large fresh-water pond 12 feet deep until that time, but the water is now brackish and 25 feet deep; it has no communication with the sea, but contains great numbers of excellent fish, named Ava, of the flavor of salmon.

The village is on the northeastern side where there is fairly good landing; there is another and more convenient landing place on the western side of the island, on a sandy beach, in front of the old village, and there is a road leading from it to the present village. In landing at either place, it is always best to insure having a gang of natives ready to haul a boat instantly onto the reef, or up the beach as the case may be.

Kaukura or Aura Island (lat. 15° 40′ S., long. 146° 51′ W.) is an atoll about 25 miles in extent east and west, and has an extreme width, near the middle, of about 8 miles.

This island was completely devastated by the severe hurricane of 1878, the houses destroyed, coconut plantations demolished, and vegetation generally so completely destroyed that for some years the atoll was not visible until close upon it, with the remarkable exception that, especially on the southern side, several enormous blocks of coral, some of them 30 feet high, washed up by the sea during the hurricane, were, and remain, visible for about 10 miles.

Since 1878 the island has been extensively replanted and has resumed much of its former appearance; the northern side is wooded from end to end, but there are only two clumps of trees along the southern side.

Villages.—There are two villages, Motu Panao on the northwestern side, where communication is most frequent, and Motu ura on the northern coast.

Passes.—At Motu Panao, a few miles from the western end, there is a boat entrance, off which the tides run with considerable strength. Vessels wishing to communicate with Motu Panao must exercise considerable caution.

The Motu ura pass, near the center on the northern side, may be known by the large groves of coconut trees, and by the ruined houses in the vicinity; it is only fit for vessels of about 15 tons; the streams off the pass follow the same rule as mentioned before, running eastward with the flood and westward with the ebb.

Apataki or Hagemeister Island (lat. 15° 18′ S., long. 146° 12′ W.) was discovered in 1830. It is about 18 miles in extent north and south and 15 miles wide.

It is wooded, except on the southern side, where the reef is under water; this part is especially dangerous by night, and in calm weather when the breakers do not show; the currents are also very strong.

This atoll has three passes on its western side leading into the lagoon; the southern pass, known as the Pakaka Pass or Schooner Passage, and the northern, named Tehere, are navigable for vessels; the middle pass, Avatika, can be used only by small craft and by them with difficulty.

Pakaka Pass (lat. 15° 32′ S., long. 146° 13′ W.) is about 5 miles northwestward from the southern point of the atoll, and is just where the western side begins to be wooded; it is about 150 yards wide and after entering bends to the southward. A white beacon stands on the southern side close to the chief's house. The tides are strong in the pass, but there is a little creek on the southern side where vessels up to 400 tons can moor clear of the stream and be well sheltered. Only vessels of less than 7 feet draft can proceed beyond the pass into the lagoon.

This pass is preferable to Tehere Pass, for although it does not permit of a large vessel entering the lagoon it offers proximity to the village an excellent anchorage, and is easy of access.

Tehere Pass, on the northwestern side and near the northwestern point, is the only one practicable for large vessels, but it is strewn with shoal patches, and it is difficult to procure a good pilot; the anchorage is inside the lagoon on either side of the pass.

The population of the island is about 150, and the only village is that at the Pakaka Pass.

Arutua or Rurick Island (lat. 15° 26′ S., long. 146° 44′ W.) is an atoll about 18 miles in extent and nearly circular. On its northern side and part of the easern side there are coconut grooves and brushwood, but the southern and western parts are quite bare and a considerable portion of the reef submerged.

On the eastern side is the Brovaki Pass, which is very indifferent, but gives small vessels access to the lagoon. On the northwestern part, marked by some large clumps of coconut trees, is a second pass, only accessible to boats.

The natives are of Tahitian origin; they were, in 1894, about 100 in number and all were Mormons.

Tikei or Romanzov Island (lat. 14° 56′ S., long. 144° 33′ W.), discovered in 1815, is a small wooded coral island about 10 miles in circumference and having no lagoon. It may be seen from the deck of a small vessel about 12 miles distant. There is a small village at the western point, where is the only and very difficult landing place. The natives, about 30 in number, are all from the island of Takaroa, and there are many cases of elephantiasis among them.

King George Islands was the name applied by Byron in 1765 to two atolls named, respectively, Ura or Takapoto, and Tiokea or Takaroa; they had, however, been previously discovered, Tiokea having been seen by Roggewein in 1722.

Ura or Takapoto (lat. 14° 44′ S., long. 145° 14′ W.) is about 13 miles in length north and south, and not more than 4 miles in breadth; it has no pass into the lagoon, and the whole circuit of the atoll is wooded.

There are about 80 inhabitants.

Landing.—Boats can land at a place named Fakatopatere about 1,000 yards northward of South Point and on the western side of the island. There is also landing 2 or 3 miles farther northward on a part of the reef named Okukina; here, in fine weather, schooners sometimes make fast to the reef.

Tiokea, northeastward of Ura, or Takaroa, is 15 miles in length, northeast and southwest, and about 5 miles wide; it is wooded in clumps on all sides.

Pass.—Near the southwestern end is Tehavaroa Pass, which admits vessels of 9 feet draft. It is about 150 yards wide and quite straight for upward of a mile in an east and west direction.

The village, with a population of about 180, is on the northern side of the pass.

A large white pyramid on which is a flagstaff, at the southeastern extreme of the wharf in the lagoon, is visible from seaward, and is a good mark for the entrance, in which the tidal stream is seldom strong enough to prevent a sailing vessel from entering far enough to anchor, when she can either be warped in, or wait until the flood tide and then secure to the wharf.

Anchorage.—There is good temporary anchorage outside the pass near the northern reef, out of the stream, in 9 or 10 fathoms. Vessels often anchor here until a gang of natives have been procured to track them in.

Vessels moored to the wharf are safe, even with winds blowing from the entrance. For vessels using the wharf, small anchors have been placed on the reef opposite the villages, but they do not hold well; the inhabitants say that during the hurricane of 1878, when the sea swept away the houses, not one vessel, well secured, was in any danger, for the water coming from the land formed a counter current which kept the ships away from the wharf; with strong westerly winds it is better, however, to haul farther in.

Wreck.—The wreck of a large sailing vessel of about 4,000 tons is situated at 3¾ miles 36° from the village on the northern side of Tehavaroa Pass. It forms a conspicuous mark from seaward.

Supplies.—Fish, fowls, and eggs can be obtained and water is abundant.

Manihi or Waterland Atoll (lat. 14° 23′ S., long. 145° 50′ W.) was probably discovered in 1616; it is about 15 miles in length northeast and southwest and 6 miles wide.

Coconut trees flourish on the islets, which are numerous all round this atoll, and fresh water can be procured on the southwestern side, where the land is about ½ mile wide.

The total population amounts to about 180, and there is a flourishing village on the eastern sides of the pass, in which is a Mormon temple and a Roman Catholic church.

The hurricane of 1878 caused great destruction in this island and much damage to the coconut trees.

Pakua Pass is at the southwestern end of the atoll. Its direction is about northeast by north; it is deep, narrow, long, and straight. The tidal streams are very strong and it can only be entered or left at slack water.

The schooners trading here generally moor in the pass, head and stern, close to the village wharf, but this is not safe if the wind comes from the southwestward or northward. In such a case a vessel should, with the assistance of a pilot, enter the lagoon and moor near a landing place in the southwest angle, from which place there is a road to the village.

Reef.—A coral reef, about 100 yards in extent, with a depth over it of 1½ fathoms, exists in the entrance to Manihi Lagoon, thus rendering the passage unsafe.

Manihi is one of the most productive islands of the whole archipelago, not only in copra, the product of the coconut, but pearl shell is abundant and of high quality. The lagoon is much encumbered with coral shoals.

Ahii or Peacock Island (lat. 14° 29′ S., long. 146° 20′ W.) is an atoll, very similar to that last described, and lies about 12 miles westward of it. Its southeastern side is about 14 miles long northeast and southwest and nearly straight, the other side forming a bow, from the southeastern side to which the greatest width is about 7 miles. The whole atoll is wooded, but is only peopled at certain times of the year by the natives of Manihi. The village is at the southeastern part of the atoll.

The pass leading into the lagoon is on the northwestern side and is both deep and wide, but the water immediately shoals on entering the lagoon.

It has hitherto been considered as fit for boats or small craft only, but later information indicates that it gives access to vessels of 1,000 tons, and there is stated to be good anchorage near the village and also in the northwest angle of the lagoon.

No stranger should attempt to proceed beyond the pass without a pilot.

Currents.—It has been found that during easterly winds the current, though usually setting westward, is feeble in the vicinity of Rahiora Island.

Rahiroa or Rangiroa, the largest of the Tuamotus, also named by various navigators Vliegen, Deans, and Nairsa Island, consists of a coral belt, very narrow, and covered with coconut and other trees throughout, except for a short distance near the southeastern point and again near the southwestern point. The reef incloses a lagoon about 42 miles in length, east and west, and of an extreme width of 14 miles.

The lagoon is so infested with sharks that agriculture has almost entirely superseded pearl fishery as the industry of the island.

Villages.—There are two villages, that of Tiputa, with about 250 inhabitants, and Avatoru, with about 230 people. Both are on the inner side of the reef. Tiputa has a Roman Catholic church and a Mormon temple; Avatoru, a church only.

Passes.—Three passes, Tivaru, Avatoru, and Tiputa, lead into the lagoon; the first, on the northwestern side, the two last, both fit for large vessels, on the northern side.

Tivaru Pass (lat. 15° 02′ S., long. 147° 53′ W.), only fit for small craft and boats, is about half way along the northwestern side of the atoll.

Northward of Tivaru Pass and close to the northwest point of the atoll is an inlet in the reef forming a little harbor and called by the natives Avatika. This word, wherever used, signifies a pass with its inner end closed by reef.

Avatoru Pass (lat. 14° 57′ S., long. 147° 41′ W.) is the western of the two openings in the lagoon on the northern side and is near the northwest point. This pass is deep, free from dangers, 400 yards wide, and is navigable by large vessels, but it is advisable to go through either at slack water or with a favorable tide, as the eddies are sometimes strong. The least depths obtained by the French naval vessel *Mesange* were 6½ fathoms at the entrance and 8¾ fathoms near the inner part of the pass.

The village commences in the pass on the eastern side and extends around this inner point eastward for 500 to 600 yards. At the eastern end of the village a mole has been built upon some reefs nearly level with the water, inclosing a space in which the native craft take shelter from the heavy sea in the lagoon, which sets in with strong southeasterly winds.

Facing the pass on entering is Brander Islet, on either side of which is a channel. A reef extends from its southern point 300 yards into the lagoon. Shoal water also extends a short distance off the northern point of this islet into the pass, and also from the inner eastern point of the pass, but both reefs are distinctly visible.

Anchorages.—The anchorage is in the pass westward of an old landing place. It is good except with northerly winds, but the ebb stream sometimes runs from 4 to 5 knots and for 9 hours, while the flood runs about 2 knots for 3 hours only. A small vessel can moor with the starboard anchor about 130 yards from the old landing place mentioned, and with a hawser from the port bow to the shore. An eddy then keeps her swung with her stern inshore out of the strength of the stream.

The inner anchorage, off the eastern end of the village, is about 200 yards off the mole. Entering by the eastern channel, give the village point a berth of about 100 yards. Small craft anchor about 70 yards from the wharf in 5½ fathoms and secure to an anchor on the coral northward of the wharf.

Tiputa Pass (lat. 14° 59′ S., long. 147° 36′ W.) is the eastern of the two openings on the northern side of Rahiroa Island. It is narrower than the Avatoru Pass, more tortuous, and the streams are stronger, sometimes running from 7 to 8 knots, but it is practicable for large vessels.

The village is on the eastern side and inner part of the pass.

Nui nui, a low islet, lies on the western side of the inner part, with a reef extending 600 yards southward from it into the lagoon.

About 1,000 yards eastward of and inside the pass is a small mole which gives the native craft sufficient shelter against the sea from the southeastward.

The anchorage is about 500 yards offshore, eastward of the mole, in 10 or 11 fathoms, coral and sand.

Caution.—In the Avatoru and Tiputa Passes the tidal streams cause strong rips or eddies (opope), which are dangerous for boats; during the flood they are found at the inner parts of the passes, and during the ebb near the outer parts.

Dangers.—Within the lagoon there is a coral bank about 3 miles 166° of the wooded islet Avatoru; a second bank about 8 miles 172° from the Tiputa Pass is of circular shape, about 200 yards in diameter, and has a depth of about 2¾ fathoms. There are also three wooded islets in the lagoon, but no other dangers are known either to the natives or pilots. Soundings of from 17 to 19 fathoms were found about 6 miles southward of Tiputa.

Tikehau or Krusenstern Atoll (lat. 14° 58′ S., long. 148° 10′ W.), about 8 miles westward of Rahiroa, was discovered in 1815; it is circular in form, about 10 miles in diameter, and is remarkable from having a small island thickly overgrown with trees in the center of the lagoon. The atoll presents the appearance all around of a series of thickly wooded islets, large and small, which are very productive.

They cultivate coconuts and taro, and in 1891 numbered about 200.

The old village was close to Tuheiava Pass, but in 1886 the inhabitants deserted this spot and established a new village on the southern side of the lagoon, about 8 miles from the pass.

Tuheiava Pass, on the western side, is suitable for vessels up to 60 tons. The French naval vessel *Taravao* attempted to enter, but could not succeed, as she found the stream always running out and very strong. This can not always be the case, as schooners enter and cross the lagoon to the village; there are several patches of coral in the way, but with a favorable light and a lookout aloft they are easily avoided.

Outside anchorage.—Northward of the pass, and outside, there is a bank where vessels may anchor in 8 or 10 fathoms, good holding ground.

Matahiva or Lazareff Atoll (lat. 14° 54′ S., long. 148° 40′ W.) is about 4 miles in diameter and circular; it is the westernmost of the Low Archipelago, and was discovered in 1820.

There is a boat entrance pass on the northwestern side. The atoll is well wooded all around without a break, except at the pass, near which are a few huts, but the island is not permanently inhabited, the people of Tikehau visiting it at certain seasons only.

Makatea, Matia, or Aurora Island (lat. 15° 48′ S., long. 148° 13′ W.), was discovered in 1712. It is a coral island, formerly an atoll, upheaved, and is about 5 miles in length east and west, and half that width; the perpendicular cliff appears worn into caverns, and the height is 230 feet, rendering it visible for a distance of 20 miles. The fringing coral reef extends 500 feet from the cliffs on the northern side of the island, and gradually diminishes in width toward the western part. The northern, eastern, and western sides present perpendicular cliffs, but the southern side descends less abruptly.

The island is covered with vegetation and has some large trees; the northern portion is cultivated and produces coconuts and sweet potatoes, chiefly on a narrow band of lowland between the cliffs and the sea.

This island is a station of the Ocean Phosphate Co. for mining phosphates.

A pier which will extend 300 feet is under construction, and moorings for five vessels have been established in deep water close to the shore.

No provisions or fresh water can be obtained.

There is a hospital under the regulation of the French Government.

Weekly communication by a steamer is maintained with Tahiti.

The village is in a bay in the middle of the northeastern coast.

Landing.—On the western side of the island are several small openings in the reef, through which landing is practicable for boats during strong easterly winds. When between two thickly wooded hills on the western side of the island, the reef will be found to be steep-to, and can be approached to within 50 yards, thus avoiding the heavy sea and strong current. The landing at the village is very bad.

CHAPTER V.

MARQUESAS ISLANDS.

General remarks.—The Marquesas Archipelago is composed of two tolerably distinct groups, discovered at different times, and for many years bearing different names; they lie in a general northwest and southeast direction, between the parallels 7° 50′ and 10° 35′ S., and the meridians 138° 25′ and 140° 50′ W. They are all high and of volcanic origin, but have no active volcanoes, nor do they seem to be subject to earthquakes. The mountains are mostly central with ridges extending from them to the coasts, between which are valleys more or less fertile. They are of very broken irregular form, and may be seen in clear weather at a distance of from 50 to 60 miles.

The southeastern group was discovered in 1895, and named the Islas de Marquesas de Mendoca, in honor of the viceroy of Peru, who had dispatched the expedition. The northwestern group was not discovered until 1791, when the islands were sighted by the American ship *Hope*, of Boston, and within two years they were visited by many others, and bore successively the names of Washington Islands, Iles de la Revolution, Hergest Islands, etc.

The southernmost island of the southeastern group was the first sighted, and named La Madalena. It was imagined to be a portion of the Solomon Islands discovered 28 years previously.

Three others of the southeastern group were named San Pedro, Santa Christina, and La Dominica. The remaining island, Fatu huku or Hood Island, was so named in 1774, after the midshipman who first saw it.

The northwestern group consists of six islands Ua pu or Adams Island, Ua huka or Washington Island, Nukuhive or Marchand Island, Motuiti or Hergest Rocks, Eiao or Masse Island, and Hatutu or Chanal Island.

Government.—In May, 1842, the state of anarchy was brought to an end by the whole united group, under the name of the Marquesas, being annexed by France, and French rule was in a few years firmly established. The seat of government under a resident is at Tai o hae in Nukuhiva Island, and the native chiefs act magisterially under his directions.

Standard time.—Standard time of the one hundred and fiftieth meridian west of Greenwich, or 10h. 0m. 0s. slow on Greenwich mean time, has been adopted for the Marquesas Islands.

Trade.—Nukuhiva, or Marchand Island, is the most important of the group, and Tai o hae or Anna Maria Bay is the principal settlement. The soil and climate of the whole group is peculiarly adapted for the growth of cotton, which is sent either to New Zealand or San Francisco for shipment to Europe.

Communication.—A line of American fore-and-aft schooners run their vessels monthly from San Francisco to Tahiti, calling at Tai o hae, or Anna Maria Bay. There is also a schooner eight times per annum between the Marquesas and Tahiti only.

Population.—The aboriginal inhabitants do not appear to have had any form of government, each tribe living separately and independently, occupying a valley formed between the mountain ridges; but for want of a head, quarrels and wars were frequent. At different periods missionaries endeavored to establish themselves, with but little success; probably owing in great measure to the bad advice and example of white deserters from calling vessels, who were found living among the natives, having adopted their customs, and aiding in their disputes and wars.

The natives appear to have originally come from the west; the race is copper-colored, of good stature, graceful form, and generally good looking, but often much disfigured by tattooing. Unfortunately they are of a very indolent disposition, and are decreasing in number. The whole population of the islands in 1905 was estimated to be 3,500, which shows a decrease since 1892 of no less than 1,000.

The climate of these islands, situated as they are in the very heart of the trade winds, is always warm and damp; notwithstanding, it appears to be very healthful, agreeing equally well with Europeans and with natives; sunstroke is quite rare.

The islands are subject to a dry and rainy season, the line of demarcation between the seasons not being so clearly marked as is often the case, showers being often experienced in the dry season, and the rains being by no means continuous in the rainy season; May, June, and July are, however, the wettest months, when the rain often falls for days together in torrents. There is a good deal of rain also in January.

Winds.—From April to October the southeast trade wind, called by the natives tua to ha, prevails in the vicinity of these islands. The general direction is east-southeast, but it varies between east and south-southeast.

From October to April the prevailing wind, called by the natives tiu, is from east-northeast, veering and backing between east and north-northeast. The wind sometimes gets to the west of north, when it is apt to turn into a gale. Gales are, however, of rare occurrence, generally occuring in December, if at all.

Land and sea breezes are commonly felt in the various bays around the islands, the former much more lasting than the latter, though both are light. The land breeze usually commences about 6h. p. m. and lasts through the night; being at its greatest strength about 5h. a. m., that is the best time for a sailing vessel to get under way. To enter a bay, a good time is about 9 or 10h. a. m., with the first of the sea breeze, for it is very apt to die away quickly, and then it remains calm all day.

The current, impelled by the prevailing trade wind, is usually to the westward, between west-northwest and west-southwest, at a rate of about half a knot an hour, sometimes, however, increasing to 3 knots. If the wind dies away or changes to the westward, the current slacks, and during persistent westerly winds its direction changes. After a week of northwesterly winds, a current setting to the esastward at the rate of 3 knots was observed in Bordelais Strait, between Hiva oa and Tau ata.

Direction.—All these islands are high and steep-to and only ordinary precautions are necessary when navigating among them; sailing vessels, however, should not approach the land too closely, even with a fresh breeze, as the wind sometimes dies away suddenly and the swell and current set toward the projecting points. When working to windward for Nukuhiva, never stand to the northward of the parallel of that island, where calms and strong westerly currents are likely to be experienced.

Caution.—When boating to places situated to windward it is best to skirt the shore as closely as possible, to take advantage of any counter current which may be found, but caution is required, as the heavy broken seas encountered near projecting points might render this course unadvisable for a loaded boat.

Pilots are hardly necessary in this group, but they may greatly assist sailing vessels in making a port by their knowledge of puffs and shifts of wind.

Supplies.—Cattle are abundant on the islands Nukuhiva and Tau ata. The Roman Catholic mission has sheep on the island Ua pu, and a number on Hiva oa or Dominica Island. Eiao is also stocked with cattle.

Matu Hiva or Magdalena Island (lat. 10° 28′ S., long. 138° 38′ W.), the southernmost of the Marquesas Group, is 8 miles in length, north and south, and 4 miles wide; the highest point is 3,675 feet above the sea.

The eastern side of the island is extremely rugged, steep ridges coming down from the central mountain and terminating in high precipices over the sea. Very few of the valleys or gorges reach the beach, so that, independently of the dangerous surf which dashes against the rocks, landing is impracticable on this side of the island. On the northern and southern ends the land slopes more regularly toward the sea, but on these parts also there is no landing.

Venus Bluff, the south-southwest point of the island, is a perpendicular rocky cliff about 700 feet high facing the sea, which breaks within a few yards of its base; from some points of view the break of the sea assumes the appearance of a reef extending farther out than it really does.

Anchorages.—There are two anchorages on the western coast, one in Bon Repos Bay near Venus Bluff, the other in Hanavave Bay about 4 miles to the northward. Both bays are open to the westward, and when westerly winds threaten it is necessary to put to sea.

Bon Repos or Omoa Bay is easily found, being at the southwestern extreme of the island just northward of Venus Bluff; the northern headland of this bay is a point of black rock 100 feet high. The anchorage is none of the best, and a heavy surf rolls continually on the beach, but landing can be effected on the rocks on one or the other side of the bay, according to the direction of the swell.

Directions.—A slender pinnacle rock of remarkable appearance, about 320 feet high, and nearly ½ mile inland from the head of the bay, rises vertically above the huts that line the shore; steer for this rock, known as Pierre Bonhomme, bearing 92°. Anchor on this bearing in 9 or 10 fathoms, when the northwest point of Fatu Hiva bears 0°.

A stream enters the bay near the middle of the beach, and is of sufficient volume to produce a constant current setting out of the bay.

Supplies.—Water can be obtained, but with difficulty, as boats must lie a considerable distance from the beach off the mouth of the stream. The valley, which winds up among the hills from the head of the bay, is very beautiful, being covered with the rich foliage of tropical fruit trees, while the native cottages and huts, sheltered under the bread-fruit, coconut, and orange trees, add greatly to the attractiveness of the scene.

Fruit of all descriptions can be procured in sufficient quantities to refresh a large ship's company; but meat and vegetables are scarce, pigs and poultry being the only animal food.

Hana Vave or Virgin Bay (lat. 10° 27′ S., long. 138° 39′ W.) affords better anchorage than Bon Repos Bay; there is also less swell, and landing is easier. The holding ground is good, and the squalls though violent are not dangerous; they blow out of the bay, and the only risk is that of being blown off the land.

Landing.—There is a sandy beach at the head of the bay, where landing is almost always easy. Boats can also land alongside some flat black rock on the northern side at the foot of some cliffs, from 250 to 400 feet high.

Supplies.—Fruit, pigs, and poultry can be obtained here, but no water.

Tides.—It is high water, full and change, at about 3h. 50m.; springs rise 3¼ feet.

Caution.—Sailing vessels passing to leeward of Fatu Hiva should not approach the land nearer than 3 miles, as they are likely to be exposed to very strong squalls off Hana Vave an dafterwards to calms and a heavy swell.

Thomasset Rock (lat. 10° 21′ S., long. 138° 25′ W.), discovered in 1844, is 14½ miles east-northeastward of the north point of Fatu Hiva. The top is only 12 feet above the sea; great caution is therefore necessary when navigating in this vicinity at night.

Motane or San Pedro Island (lat. 9° 58′ S., long. 138° 50′ W.) is 5 miles in length and north-northwest and south-southeast, 1,640 feet high, and wooded on the summit and in the ravines. Separated from the southeastern point by a narrow boat channel is a large high rock.

The island is not permanently inhabited.

Tau Ath or Santa Christina Island (lat. 9° 57′ S., long. 139° 03′ W.) is 9 miles long north and south and 5 miles across in the widest part. A narrow ridge of mountains of considerable height extends the whole length of the island, the highest attaining an altitude of 3,280 feet. Other ridges rising from the sea join the main ridge with a regular ascent. These are separated by deep, narrow valleys watered by fine streams of excellent water.

Supplies, etc.—The island produces cotton, cocoa, coffee, sugar-cane, and fungus. There are wild cattle in the mountains, but difficult to get at and still more difficult to carry away when shot. The inhabitants in 1880 were estimated at 450, but have decreased in number since then.

The formation of the island, with its steep coast on the east and numerous valleys on the west, closely resembles Fatu Hiva. The eastern side should therefore be carefully avoided, the only two possible anchorages as now described being on the western side.

Vaitahu or Resolution Bay is near the middle of the western side of the island and under the highest land. The French settled in this bay in 1842, but subsequently abandoned it. The population is now 120. The southern point of the bay is a steep rock of considerable height, terminating at the top in a peaked hill. The northern point is not so high and rises with a more gentle slope. The points are about 1,000 yards apart, and the bay recedes about that much from a line drawn between them.

There are two sandy beaches at the head of the bay, divided from each other by a rocky point. In each there is a rivulet of excellent water. The northern cove, named Vaitahu, is the most convenient for obtaining firewood and for watering. Here there is a small waterfall. The village in the southern cove is named Hanamiai.

The sea breeze is rarely felt at this anchorage, but with northerly winds there is swell enough to cause a vessel to roll disagreeably. The rare winds from west and west-northwest blow directly into the bay, but they do not produce a correspondingly heavy sea.

It is said that vessels have been driven to sea from this anchorage by the violent gusts down the valleys, and altogether the bay has such a bad character that whalers seldom enter.

Directions.—The best marks for finding Vaitahu Bay are Fort Halley, built on a hill and visible from a long distance when bearing between east and southeast, and two large white houses on the beach. In any case, a vessel on the meridian of the western point of Tau ata and running north or south until the western extreme of Hiva oa bears 348°, or until Bordelais Strait appears completely closed, will be off Resolution Bay.

Sailing vessels from the eastward with the trade wind should pass northward of the island and run down the coast. The breeze drawing along the land will carry them almost to the entrance. Entering the bay, skirt as closely as possible the northern point, which is steep-to. While working in watch the puffs carefully and endeavor to avoid being struck by a gust from the hills when in stays.

Anchorage.—In 1867 the British naval vessel *Topaze* anchored in 26 fathoms, with the western point of Hiva oa bearing 345° and the southern extreme of land 205°; she remained here for two days without experiencing any difficulty from the swell or squalls from the mountains. There is no doubt, however, that a heavy swell from the southwestward does set in at times, for a landing place constructed by the French at considerable expense has been washed away, and there are other marks of destruction by the waves.

The violent gusts down the valley may cause a vessel anchored on a sloping bottom to drag off, but if anchored well to the northward she will clear the southern point of the bay.

Landing.—Boats can land, in fine weather, on the beach in the southern part of the bay, where there is no coral, but the usual landing place is at the steps cut in the rock to the northward of the beach.

Water.—In fine weather excellent water, easily obtained, is to be had at the southern end of Vaitahu Beach, where the spring bursts out from a rock, and it is only necessary to suspend a hose under it and let the water run into the boat. Water can also be obtained in Hapatoni Bay, but it is of inferior quality and the operation very difficult.

Hapatoni Bay, 2 miles southward of Vaitahu Bay, is a bad anchorage occasionally used by whalers. A rock resembling a tower on the southern point of the bay marks the entrance. Boats can generally land in a little creek sheltered by a point. Population is about 120.

Bordelais or Haava Strait (lat. 9° 52′ S., long. 139° 04′ W.), separating Tau ata from Hiva oa, is 2½ miles wide, and both sides are clear and safe. There is nearly always a fresh breeze and a relatively rough sea in this channel.

The current sets generally to the westward at from 2 to 3 knots, and when this is the case it is almost impossible to beat through to the eastward. When westerly winds have prevailed for some time, the current is reversed and sets eastward with about the same velocity.

Hiva oa or Dominica Island (lat. 9° 45′ S., long. 139° 00′ W.) is the largest, the most fertile, and the most populous of the whole group. It is 22 miles long east and west, with an average breadth of 6 miles. The highest mountain summits are Heani Peak, 3,520 feet high, toward the western end of the island, and Ootua Peak, 3,032 feet high, in the central eastern half. It has some well-watered beautiful valleys, the soil is extremely rich and well suited for coffee, sugar, cotton, and other tropical products. Unfortunately the natives are reported to be both lazy and turbulent, consequently agriculture and trade make but little progress, though, since 1880, a few Europeans have settled on the island, and both cotton and coffee are now being cultivated to some extent.

In 1880 the native population of Hiva oa was estimated at 2,500.

Cape Balguerie is the eastern point of the island; the hill rises above it to the height of 1,280 feet, and at the foot are several isolated rocks, the northernmost of which is in the shape of a truncated cone. The coast westward of this consists of barren cliff and white sandy beach, without shelter or inhabitants, for a distance of 5 miles, at which distance, on the northern side, is Puamau Bay.

Puamau, or Perigot Bay (lat. 9° 45′ S., long. 138° 53′ W.) may be recognized by its wooded amphitheater and the mountains around, the westernmost of which is 2,820 feet high. The hill on the eastern side is 575 feet high, and is surmounted by a natural obelisk or column composed of two vertical rocks separated by a fissure, but which in certain positions appear as one rock. The Roman Catholic mission, also the fort at the head of the bay, are good marks.

This place is populous, but has few resources, though a few traders have established themselves here, and it seems destined to become a place of some importance.

About 300 yards from the eastern point, and within the bay, are the Jacquemart Rocks; coming from the westward they can not be distinctly made out. Although the depth between these rocks and the point is from 7 to 9 fathoms, it is advisable to pass westward of them, and also of the Boulard Shoal, 200 yards northward of these rocks, on which there are 2¾ fathoms. Sailing vessels should invariably observe this rule, as the wind is very apt to die away near the land.

Anchorage.—The best anchorage is in from 10 to 12 fathoms, good holding ground, with the following bearings: Bastion Point, the western point of the bay, in line with the eastern point of Fatu huku 355°; and the obelisk on the hill over the eastern point of the bay, seen between the two Jacquemart Rocks, 107°.

During the years 1880 and 1881, the French naval vessel *Chasseur* anchored frequently at Puamau Bay in all kinds of weather. There is always a swell, and with the wind to the northward of east by south, vessels roll very disagreeably.

With a fresh breeze from northeast to north-northwest the sea becomes heavy in the bay. Steamers have little difficulty in putting to sea, but sailing vessels often find some difficulty, especially during the season of northeast winds, from October to April; the land breeze frequently fails, and as both swell and current set directly against Bastion Point, there is great difficulty in weathering it.

Landing on the open beach is very difficult and often impossible. Boats usually land on the eastern side on a small beach protected by some rocks which extend to the southwestward; the place is marked by a conspicuous tree.

Supplies.—A few fowls, eggs, etc., may be obtained here, and watercress may be gathered by the mountain streams, which abound, but water can only be procured with great difficulty.

The coast.—Proceeding along the northern coast to the westward there is Hana hepu, then the small wooded bay Jaone, and farther on the inhabited bay, Naa o he, where there is anchorage for small vessels and good landing on a sandy beach, so long as the wind is not northward of east-northeast. Then come Motuua and Sha nahe or Hanaki Bays; the latter affords good anchorage for small steamers in about 14 fathoms in the entrance, and shoals gradually toward the shore; the narrowness of the entrance makes it difficult of access to sailing vessels. This bay may be recognized by the ironwood trees which cover the western cape. Landing is generally easy on the sandy beach at the head of the bay.

Westward of Hanaki is the large open bight, Hana paa owa, where there is neither landing nor anchorage. There is a church and a few huts among the trees.

Westward of this bight, the coast trends northward and northwestward for about 2 miles to Cape Mautau, the northernmost point of the island. Beyond this point the general trend of the coast is east and west.

Rock.—About 1,000 yards 19° from Cape Mautau is an isolated double-headed rock, just awash, on which the sea always breaks; there is plenty of water between the rock and the shore.

Hana te kua is a small bay just westward of Cape Mautau. Coming from the westward, the church in the middle of the beach is a good mark. Fatu huku Island bears 17° 15 miles from the eastern point of the bay.

The anchorage is in 6½ fathoms, midway between the two sides of the bay.

Boats can land without difficulty on the western part of the beach, near a small stream of excellent water.

Hana iapa (lat. 9° 43′ S., long. 139° W.) affords good anchorage, with sufficient shelter during northeast winds, and the holding ground is good. Good marks for distinguishing this bay are Borne Island, 49 feet high, about 300 yards off the western point of the bay; and a fine cascade, about 1 mile westward of the bay, which can be seen from seaward at a distance of 10 miles. The anchorage is in 10 or 11 fathoms, with the eastern point of the bay in line with Fatu huku. Boats land on the eastern end of the beach, behind a little point of rocks, around which, and at a distance of about 100 yards, there is a line of breakers which must be left on the port hand going in.

Supplies.—Cattle and sheep are delivered on board by the natives at this bay at moderate prices. A fine stream of water flows into the bay close to the landing place, but it can only be procured for ship's use with great difficulty.

Directions.—The current generally sets westward, and the wind dies away at the entrance of the bay, giving place to the land breeze. Sailing vessels, therefore, entering this bay, should keep well to windward and run in with the wind free, passing about 200 yards from the eastern point. The passage between Borne Island and the western point, in quitting the bay, is dangerous for sailing vessels.

Coast.—For about 7 miles, until the next anchorage is reached, the coast is broken by several little bays, on the shores of which houses will be seen. There is no communication by land between these bays, as they are separated from each other by rugged barren rocky ridges.

Hana menu (lat. 9° 45′ S., long. 139° 08′ W.) is near the northwestern point of Hiva oa. The Grosse Tour, a cliff of dark rocks, like an enormous tower, 735 feet high, at the end of a mountain ridge jutting out from the head of the bay, divides it into two bays. The principal bay is that on the eastern side of the Grosse Tour. It was much used by whalers, and may be recognized, even at night, by the Grosse Tour.

Sailing vessels can make this anchorage without difficulty, for the sea breeze draws round the eastern point of the bay. When putting to sea take advantage of the land breeze or kedge out. With the wind from southeast to east the sea is smooth; with a northeast wind the swell is felt in the bay, but the sea is rarely heavy. The land breeze ordinarily makes at about 7 p. m. and subsides at daylight.

Anchorage.—The best anchorage is in the eastern bay, in 11 fathoms, with the western point of the bay a little open of the Grosse Tour Cliff. Landing is easy at the head of the bay, and there is an abundance of good water.

Coast.—From Bonnard Point, the western point of Hana menu, the western coast of Hiva oa, high rugged, and except in a few little bays inaccessible, curves away to the southward and southeastward for about 12 miles to Teachoa Point, the southeastern point of the island, immediately round which point is a deep bight named Vi pi hai or Traitors Bay.

In the northwestern part of the bay is the small rocky island Hanake, about 120 feet high and steep-to. Westward of this island the bay is exposed to the prevailing wind and sea, and anchoring is impossible near the shore. Landing is always very difficult, if not impossible.

Taa hu ku Bay (lat. 9° 48′ S., long. 139° 02′ W.) is eastward of Hanake Island, and is not easy to make out if coming from the eastward, the island appearing as part of the mainland. An excellent mark for its recognition is a steep grassy slope on the western side of the head of the bay, with several houses and buildings forming a fortified position on the summit.

The extreme of Teachoa Point in line with the eastern extreme of Tau ata Island leads nearly up to the entrance. Having left the island about 300 yards on the port hand, the entrance will be seen ahead, the western entrance point being black and the eastern a low flat point. The fort above mentioned and a road which runs along the western side of the bay are equally good guides.

Anchorage.—The bay is well sheltered and there is good anchorage for vessels of medium size over an area about 900 yards long by from 400 to 300 yards wide; a large vessel could haul in and moor in all security. The holding ground is good. The sea breezes are never felt, but the swell is sometimes disagreeable. With the wind from southeast to east, the sea breaking on the western side of the bay is thrown back against the eastern side, the backwash producing a chopping unpleasant sea.

The usual anchorage is in the middle of the bay in 5 or 6 fathoms. Sailing vessels should skirt the eastern point at a distance of about 100 yards, and their headway will thus generally carry them up to the anchorage. Land breezes, blowing from north to northeast, generally prevail during the night; they attain their greatest strength about daybreak and die away between 8 and 9 a. m. Sailing vessels going out should profit by this circumstance.

Those not wishing to enter the bay can anchor southward of the entrance, in 17 fathoms, muddy sand, about 1 mile eastward of Hanake Island, with the following bearings: North point of Motane 126°, east point of Tau ata 182°.

Landing places.—Access to the beach at the head of the bay is often difficult, but there are landing places on each side of the bay and the footpaths leading down to them can be seen from the anchorage; the best place is on the eastern side.

Supplies.—A stream of water on the western side affords abundance of good water during the rainy season. The village of Atuona is just westward of this bay; it is one of the largest in the island, and from it live stock, fruit, etc., can be obtained as well as, or better than, at any other anchorage.

Current.—The current generally sets westward along the southern coast of Hiva oa, but in Vi pi hai Bay it follows the trend of the coast and sets toward Teachoa Point. After rain its strength is considerably increased, owing to the numerous streams which fall into the bay.

Coast.—Between Taa hu ku Bay and Cape Balguerie there is no good anchorage, the coast generally consisting of perpendicular cliffs of considerable height.

Fatu huku (lat. 9° 26′ S., long. 138° 55′ W.), 15½ miles north of Hiva oa, was discovered in 1774, and was named Hood Island. The island is 1,180 feet high, of but small extent, and consists of a single high rock, flat at the summit, and with a gentle slope from north to south.

The island is barren and uninhabited; the natives of neighboring islands state that landing is impossible, but, though it has not been attempted, there is a place on the southern side where it would appear that under favorable circumstances a landing might be effected. Fish are abundant around the coast, and native canoes from other islands occasionally resort here for fishing purposes.

Rocks and shoals.—D'Urville reported a rock on which the sea generally breaks about 1 mile 345° from Fatu huku; another bank is said to exist northeastward of the eastern point of the island.

The French vessel *Infernet* saw discolored water in this neighborhood and also the swell evidently almost breaking. At 1 mile eastward of the island the same vessel had soundings of 6 and 7 fathoms.

Ua pu or Adams Island (lat. 9° 23′ S., long. 140° 04′ W.) is about 8½ miles long north-northwest and south-southeast with an extreme width of 7 miles; it contained in 1880 a population of about 430. The island is high, bold, rocky, and picturesque in the extreme. The summits of many of the mountains take the form of conspicuous columns, spires, and pinnacles, the highest point being 4,042 feet above the sea level. In the southeastern part of the island is a remarkable table mountain, topped on each side by a lofty spire. On the southern side are several detached islets of volcanic rock, of which the two largest are named from their respective forms, Obelisk or Sugar-loaf, and Flat Island. Off the northeastern point are two barren islets, with a dangerous boat passage inside them. Northward of these islets, at a distance of from 1½ to 2 miles, the depth is from 17 to 23 fathoms, sand. The whole of the eastern side being exposed to wind and sea, affords no anchorage; the western side abounds in villages, and has several convenient anchorages.

Near the North Point is the little flat islet Motaukuii, between which and the shore the current sets westward with considerable strength; this vicinity should therefore be avoided.

Westward of the islet, the general direction of the coast is southwesterly, at first broken by two unequal bights, separated by a massive point of rocks, with sand beaches at their heads.

Aneau Bay is the easternmost of the bights above mentioned, the entrance to which is wide, but divided into two by the red-colored Tauna Rock on which the sea always breaks. When using the eastern or weather pass, care should be taken to keep close to the eastern shore, 100 yards from which there are not less than 6½ fathoms. In 1876, the French vessel *Vaudreuil* found 4 and 5 fathoms in the middle of the eastern pass, and 6½ fathoms immediately after passing the rock.

The western pass is much wider and deeper, about 11 fathoms everywhere, and is preferable for steamers.

Anchorage.—In the inner part of the bay, with winds between southeast and east-northeast, the sea is smooth, but the swell enters more or less. This anchorage is not recommended, and unless compelled to do so, large vessels would do well not to pass the night in it. Anchorage may be obtained in the eastern part of the bay in 6½ fathoms, but a better berth is 210° of the rock in the pass; here the swell may be heavier, but there is more room for swinging, and it is easier to get out under sail.

Landing may generally be effected without difficulty in the northeastern part of the bay.

Hakahe tau (lat. 9° 21′ S., long. 140° 04′ W.).—This port or bay lies on the northern side of the island, next westward of Aneau Bay and directly under the western peak; it affords fairly good anchorage with winds from northeast, through east, to south. Approaching from the eastward the coconut trees around the huts, the red rocks on the eastern side, Reddish Islet in the bay, and the hut on the western point of the bay are good marks for its recognition. Farther eastward is a red cliff with a cavern.

Landing is easy at a natural rocky mole, at the mouth of a small river.

Vaieo Bay, a bight in the western extreme of the island, is wide but not deep. With the usual easterly winds there is perfect shelter and good anchorage in 11 fathoms, but it is untenable with westerly winds.

The best anchorage for large vessels is with the following bearings: North point of bay 320°, middle of the northeast bight about 39°, and the Sugar-loaf at the southern point of the bay 182°. Small craft can go farther in to the northeastward and anchor in 8 or 9 fathoms.

In the southern part of this bay is Hakaotu Bight, where small craft find temporary shelter.

Coast.—From Vaieo Bay the coast trends southeastward for about 5 miles, past the bights Hakamaii, Apateki and Hikeu, in which vessels may find temporary anchorage in fine weather. It is generally calm with occasional squalls along the whole western coast, so that sailing vessels find some difficulty in reaching their intended anchorages.

Akatau or Bay of Friends, near the southern point of the island, affords fairly good anchorage, but there are often heavy gusts from the southeastward, and always a somewhat heavy swell. To the southward is the Obelisk, the remarkable sugar-loaf rock before mentioned. The anchorage is in the second bight northward of this rock; it may be recognized by the native huts and a small chapel in the southern part of the bight.

At this point of the island the wind is generally south, blowing on shore; sailing vessels should, therefore, anchor abreast of the bight, half way between the two rocky points, so as to be able to leave at anytime. Steamers can go farther into the bay.

Landing may be effected on the rocks to the right of the shingle beach, but with some difficulty.

Coast.—The weather side of the island trends northward for about 5 miles to the northeast point, passing in succession the Bays Hohoi, Paumea, and Hakamui, fully exposed to the trade wind, without anchorage, and where the landing is very difficult.

Hakahau Bay.—From the northeast point the coast of Ua pu trends to the northwestward for about 4 miles. The second bight from the point is Hakahau Bay, where the Roman Catholic missionaries have their principal establishment. The anchorage is bad (coral bottom) and should only be used in case of absolute necessity. Landing may be effected on a sand beach in the southeastern part, but generally with difficulty on account of the surf.

From the offing, neither the native huts nor the mission buildings are visible, being concealed by the trees. When communicating with the shore, vessels should heave-to well to windward, as the current sets strongly to the westward.

Ua huka or Washington Island (lat. 8° 54′ S., long. 139° 33′ W.), is 7½ miles long east and west, about 5 miles wide, and lies about 23 miles 93° from Nukuhiva, the largest island of the northwestern group. In 1880 it had a population numbering about 260. On the southern side are the two bights, Vaitake and Hannay Bays, in which anchorage may be obtained, the best being Hannay Bay. The western side appears the most fertile and at the southwestern end is Shavay Bay.

Outside the anchorages, and all round the island, there are said to be depths of from 22 to 25 fathoms at distances varying between ½ mile and 2 miles from the shore.

Off the northern coast are several small detached rocks.

Shavay Bay.—Off the southwestern point of the island is Hemeni or Height Island, conical in shape, 318 feet high, and about 1½ miles in circumference, with Motu Keo Keo, a small detached islet, off its western end; inside it is Teuaua or Hat Islet, a small island; both are much frequented by sea birds. Northward of these islands is Shavay Bay, an anchorage affording shelter with winds from north, through east, to the southeastward. Vessels are protected from the swell by the islands, and the depth is from 11 to 16 fathoms.

Anchorage may be obtained anywhere between Hemeni Island and a sand beach on Ua Huka, but do not anchor eastward of the meridian of Hemeni, as the bottom in that part is said to be rocky and uneven. The only inconvenience of this anchorage is that it is nearly 3 miles from Vaitake Bay, the nearest inhabited part.

Vaitake or Invisible Bay, the easternmost of the two bights on the southern side of the island, is very appropriately named, for not until right opposite the entrance can it be recognized as a bay or the sandy beach at its head be seen.

A short distance eastward of the two islands which form the protection to Shavay Bay anchorage is a black cape about 300 feet high, which at a distance has the appearance of a wedge inclined toward the land. A little farther eastward between two black cliffs is the narrow entrance to Vaitake Bay, which lies in a north-northwest and opposite direction.

At the entrance where the depth is 17 fathoms there is always a heavy, choppy sea. Only small craft can use the bay, for although deep there is no room for swinging, and as the land breeze is by no means regular it is often difficult for a sailing vessel to get to sea. With winds from north to east the sea is perfectly calm inside, but with it southward of east-southeast the surf sets in and the place becomes dangerous.

At the head of the bay is a beach, with coconut trees, and the houses of the few Europeans who have settled here. In the eastern part is a small river, at the mouth of which landing may easily be effected in fine weather.

Coast.—A little eastward of Vaitake is a small uninhabited bay, in front of which is a large flat rock resembling a breakwater; then comes a large bluff with a reddish horizontal band across it at two-thirds of its height. All this part of the coast is rugged and studded with rocks and islets; among the latter is Motu papa, a red islet, the sides of which are perpendicular and the upper part a plane inclined toward the land.

Hannay Bay may be known by Motu Haane, a sugar-loaf islet 508 feet high, on the eastern side of the entrance. This islet can not be mistaken on account of the dark reddish violet color of the rocks.

The bay recedes about 1,400 yards from the island and its width varies from 700 yards in the entrance to 300 yards near the land. The anchorage for a large vessel is in about 15 fathoms, with Motu Haane bearing 98°. Smaller vessels with power may safely run well up the bay, at the head of which are a few houses and a good stream of water, with a beach of sand and gravel on which, however, landing is almost always difficult on account of the surf.

This bay is connected with other inhabitated parts of the island, and especially with Vaitake Bay, by a road plainly visible from the offing.

Nukuhiva or Marchand Island (lat. 8° 52′ S., long. 140° 09′ W.) the principal island of the Marquesas Archipelago, is 14 miles in length east and west and 10 miles wide. The principal places of resort and the best anchorages are to be found on its southern coast, one of which, Tai o hae, is the port of call for schooners running between San Francisco and Tahiti.

It is mountainous, the highest peak in the northwestern part rising 3.890 feet above the level of the sea, while two others are between 2,000 and 3,000 feet in height, these lofty rugged rocks being very steep toward the sea, and from the mnumerous cascades are precipitated, among which one at the southern end of the isladn is particularly remarkable. The bed of this waterfall appears to be several yards wide and the water is precipitated from a rock over 2,000 feet high. This cascade is the source of the river, which empties itself into Port Tai oa.

On the southern side are three harbors, where ships may lie in perfect safety, viz, Comptroller Bay, Tai o hae or Anna Maria Bay, and Port Tai oa. Between the two latter are two bights or bays, which, however, do not afford anchorage, being full of rocks and exposed to the wind. This southern coast has, within 1 mile of the shore, depths of from 35 to 50 fathoms over a fine sandy bottom.

Produce.—Nukuhiva offers great natural opportunities for cultivation, for the valleys are broad, well watered, and possess rich soil. Tropical fruits abound as in the other islands, but vegetables are scarce for want of labor and industry. From the same cause the guava is reported to be fast overrunning the land and destroying the breadfruit and many other valuable trees.

Population.—The total number of inhabitants in Nukuhiva in 1880 was estimated at 800.

Cape Martin or Tikapo is the southeastern point of Nukuhiva, and is very abrupt, being capped by masses of rock in the form of a tower, which, when seen from the southwestward, appears to incline toward the sea. The cape is steep-to, as is also Te oho te kea, or Sail Rock, 12 feet high, which lines 600 yards south of the cape, and may be taken for a boat under sail when standing out against the sky. Between the rock and the cape the depth is from 23 to 32 fathoms.

Comptroller Bay (lat. 8° 54′ S., long. 140° 00′ W.), immediately westward of Cape Martin, is about 2 miles across and divided at the head into three coves, each of which trends in a north-northwesterly direction. Vessels generally anchor in these coves, as outside of them the swell is heavy and the depth from 26 to 30 fathoms.

Huumi is the eastern cove; it is 600 yards wide in the entrance, the sea is usually calm, and landing easy on the sand. The anchorage is well within the entrance in from 9 to 12 fathoms, midway between the shores.

Hanga haa, the middle cove, runs in more than 2 miles, and the best anchorage is in about 14 fathoms, a little northward of the bluff point which separates it from the next bight to the westward, where the width is about 1,000 yards.

Haka paa, the western cove, is divided into two at the head; in the northernmost a small vessel may anchor; the anchorage for a large vessel is just abreast of the bluff point before mentioned in about 17 to 20 fathoms.

Sailing vessels find some difficulty in reaching either of these anchorages at times on account of the wind falling, though as a rule the wind in the interior of the bay blows in the same direction as that outside, but incining more to the southeastward at the entrance of the two western coves. In the early morning a land breeze generally blows out of each cove.

Water of good quality may be obtained in each cove from the stream flowing into its head.

The current near Sail Rock and at the entrance to the bay is somewhat variable, sometimes running to the eastward, but it generally follows the direction of the trade wind.

Tai o hae or Anna Maria Bay is about 5 miles westward of Comptroller Bay and may be known by the islands one on each side of the entrance and 1,500 yards apart, most appropriately named the East and West Sentinel. The bay recedes 1½ miles northward from the entrance, and in the narrowest part is upward of 1,000 yards wide, forming a fine basin without a detached danger of any sort, and with depths of 27 fathoms in the entrance decreasing to 6 and 7 fathoms at 500 yards from the head. During the season of northeasterly winds, i. e., from October to March, the swell is hardly ever felt in the bay, but during the remainder of the year there is sometimes a good deal of swell in the bay and surf on the shore.

Hakapehi.—On the northeastern shore of the bay is the village and settlement of Kakapehi, with Fort Collet, in ruins, occupying a small green hilly headland on which is the Government flagstaff; the French authority being represented here by a resident and a harbor-master, who also acts as a pilot. A short distance northward of this headland is a small pier 82 yards long, at the head of which boats can generally land. The population is about 350.

Harbor light.—A small fixed red light, visible about 3 miles, is shown from the position of the flagstaff on the remains of Fort Collet.

Directions.—If it can be seen on approaching, as it usually can, that the breeze is blowing into the bay, a sailing vessel should enter at once.

Care is necessary both on entering and leaving not to approach the western shore too closely, as an easterly wind and pretty strong westerly current render the lee shore dangerous.

With a steady fresh breeze in the bay the entrance is perfectly safe, but with a light and unsteady wind, such as frequently prevails, owing to the lofty surrounding mountains, no reliance must be placed on these unsettled breezes, which veer in one moment from east to west, now coming in violent gusts and immediately after falling dead calm.

For a steam vessel the navigation of the bay presents no difficulty.

Anchorage.—The eastern side of the bay has a decided advantage over the western side for anchoring, the current not affecting the ship to the same degree, and the chain consequently being less liable to foul. All vessels should moor, with the swivel on, however short their stay, for, if at single anchor, the sudden puffs and shifts of wind, especially frequent during the night, are almost sure to cause a foul anchor and the ship to drag.

Supplies.—Good beef, vegetables, and bread can be obtained, but at high prices. Water can be obtained near the mole, but there is no coal.

Tide.—It is high water, full and change, at 3h. 50m.; rise of tide 4¼ feet.

Current.—There is generally a current, depending much upon the strength of the wind outside. Striking the western side of the bay, it sets northward up the bay, then across the head from west to east, and then southward down the eastern side.

Coast.—For about 5 miles westward of Tai o hae the coast is rocky and broken by several bays, none of which afford any shelter. The largest, that of Ua uka, being very exposed. A beautifully fertile valley extends northeastward from it into the interior of the island. Immediately westward of this bay is the port next described.

Port Tai oa.—At the entrance of this bay, the western side of which is formed by lofty and perpendicular rocks, there are 20 fathoms water over a fine bottom of sand and clay. On the eastern side of the entrance is the long rocky point and slight indentation on the whole of which the sea breaks heavily and which divides this bay from the exposed bay of Ua uka just now mentioned.

Hakatea—Hakaui.—After passing the western extreme of this long rocky point the fine basin of Hakatea Cove opens out, trending in a northeasterly direction about 1,000 yards and 400 yards wide. At the head is a sandy beach, behind which is a green flat. This basin is so completely landlocked that storms would scarcely affect the water, and a ship in need of repairs would find it convenient for such a purpose. The depth is from 4½ to 7 and 8 fathoms. The western cove is named Hakaui and is shallow. An abundant stream of water flows into its head, from which water may be procured at and above half tide.

There is a small village in each cove.

Supplies.—Bananas, coconuts, and breadfruit are abundant, but animal provisions are scarce.

Coast.—The western or leeward coast of Nukuhiva is named Henua Ataha, or desert land, and instead of being steep and abrupt, slopes gradually up to the mountains. The natives come here to fish, but there is no harbor.

A sailing vessel should avoid this coast, where calms, caused by the high lands, extend 2 or 3 miles offshore.

The eastern coast of the island trends northward from Cape Martin 9 miles to Atupa atua, or Adam and Eve Point, and for one-third of the distance it is an almost perpendicular cliff. Atupa atua is the northeastern point of the island; on the extreme point and at two-thirds of its height are two singular rocks, which, seen in some positions, look like grotesque statues of a man and woman, hence the name. They are generally called Jack and Jane.

The current runs with great strength round this point.

The bay of Aa tua tua is a deep bight in the eastern end of the island immediately southward of Atupa atua Point. As it lies open and exposed to the ordinary wind and to the full force of the sea, it need scarcely be said that it should be carefully avoided and landing in it never attempted.

The northern coast trends generally east and west for 13 miles, and is indented by several bays, some of which are deep, but from October to April, the season of northeasterly winds, which veer to the northward, there is a heavy sea in most of them.

Hataivea, a large but exposed bay where the natives sometimes beach their boats, is the first westward of Atupa atua Point. Off the western entrance point is Motu iti or Poiku, a pointed rock, generally swarming with sea birds, which also marks the entrance to Anaho, the next bay.

Anaho Bay is a good anchorage, where vessels do not generally roll. The bay recedes about 1¾ miles in a southerly direction, and the head on the western side is fringed by coral reef which dries in patches at low water.

With winds from southeast to east-northeast the sea is calm, but when from northeast the surf begins to be felt. Sailing vessels have no difficulty either in entering or leaving the bay, and formerly it was much resorted to by whalers.

The head of the bay is only separated by a narrow isthmus from that of Aa tua tua on the eastern coast.

Anchorage—Depths.—The depth of water in the bay decreases gradually from 25 or 26 fathoms in the entrance to 7 or 8 fathoms at 300 yards from the head. Therefore, in case of need, an anchor may be let go almost anywhere. The best anchorage for sailing vessels is on the eastern side, opposite the Blow Hole, in 15 fathoms. Steamers anchor in about 10 fathoms near the western anchor marked on the chart on account of being nearer the landing place. They should not go any farther to the westward, but should keep the entrance of the bay well open.

Landing can be effected without difficulty on the beach by passing through an opening in the reef opposite some huts on the shore, as the water is always smooth there.

Caution.—When leaving the bay sailing vessels should be prepared for a strong westerly current. When sailing from an anchorage taken up too far to the eastward, they may find a difficulty in weathering Mesange Point, notwithstanding the east-southeast squalls coming over the isthmus from Aa tua tua.

Atiheu Bay.—The eastern extreme of this bay, the third bay westward from Atupa atua Point, is about 5 miles from that point, and may be recognized by a bluff of brown rocks, over which towers a peak 980 feet high. The bluff itself is 246 feet high, and vessels can go close alongside as there are 15 fathoms at the foot. The western side of the bay terminates in a comparatively low point.

Coming from the northward or westward the residence of the Roman Catholic missionary will be seen at the entrance of Atiheu Bay, a white house on comparatively low ground.

Anchorage.—Proceed about 1 mile into the bay, which recedes nearly 1½ miles from the eastern point, up to which the water is deep. In many places, opposite points projecting from the eastern side, the bottom is rocky for some distance from the shore. The best anchorage is opposite a small bight in the southeastern part of the bay in 12 fathoms sand, with the western point of the bay bearing 316° and the eastern point 8°.

Violent squalls from the southeastward sometimes blow from the steep mountains in the inner part of the bay. During the season of northeasterly winds, the sea is sometimes very heavy and nearly always rough. At any time it is difficult to beat out on account of the variableness of the squalls.

Landing on the beach in the northeast season is difficult, if not impossible; but, with proper care, it may generally be effected on the rocks in the southeastern part of the bay opposite the anchorage.

Haume Bay is a slight indentation of the coast just westward of Atiheu, and is not inhabited. Landing is at all times difficult on the gravel beach.

Hakapa Bay is an almost semicircular indentation about 7½ miles westward of Atupa atua Point, and exposed to all winds from east-northeast, through north to northwest, without anchorage and, at the best of times, very difficult landing on account of the large rocky bowlders lining the shore, on which the sea breaks. The corresponding valley is densely wooded, and the native huts may be seen among the trees half way up the hill at the foot of very steep mountains.

Hapapani and Vaekao Bays.—Westward of Hakapa is a bight in which are the two very small bays, Hapapani and Vaekao. Several vessels have anchored in the former during the season of southeasterly winds. These bays are directly overlooked by the highest peak of the island, only 2 miles distant to the southward.

Hakaehau Bay.—From Vaekao, instead of a continuation of abrupt cliffs, the land descends in gentle slopes toward the sea, the beginning of the desert portion of the island. Westward of the second point from Vaekao is Hakaehau Bay, inhabited by the Pua Tribe. It is difficult to distinguish, but the eastern part of the highest mountain in the island bearing 142° leads to the entrance.

The eastern point of the bay is a promontory of black rocks, which sailing vessels should pass close to when coming to an anchor.

Hakaehau is a small basin about 800 yards long and 500 yards wide, lying well sheltered from ordinary winds. With a good breeze blowing from east-northeast and a heavy sea outside, it is quite calm in the bay. The only winds to be feared are those from the northwestward.

The depth in the middle of the bay is 8½ fathoms, gray sand, gradually increasing to seaward. One mile northward of the eastern point are 22 to 26 fathoms, gray sand; so that sailing vessels can kedge out and make sail. The land breezes from east-southeast to southeast are, however, generally felt in the morning, and should be taken advantage of to get to sea.

Formerly a good many whalers visited Hakaehau, but they generally anchored at the entrance of the bay.

Motu hi is a small bay about 1 mile westward of Hakaehau. It does not afford anchorage.

Motu iti or Hergest Rock (lat. 8° 41′ S., long. 140° 36′ W.), 24 miles to the westward of the northwest point of Nukuhiva, is a volcanic rock rising 720 feet above the sea; with the exception of a little verdure on its lee side it is entirely barren, and it is quite inaccessible. Eastward of it are two other islets, almost connected with each other by rocks awash, devoid of vegetation, and much lower than Hergest Rock; they swarm with sea birds, are covered with a deposit of guano, and appear quite white when seen in the distance.

Soundings.—These rocks are surrounded by a bank of muddy sand and coral, on which as little as 15 or 20 fathoms is found 2 miles from the rocks. Almost touching the western side of the large rock there are 6 or 8 fathoms. At the eastern extreme they are prolonged for a short distance by rocks under water.

Landing is impossible on the large rock at any time, and nearly so on the others. There is an abundance of excellent fish around them, and native craft come from a long distance for the fishing.

Lawson Bank (lat. 8° 43′ S., long. 140° 46′ W.)—The master of the trading sloop *Peep-o'-Day* reported that on May 2, 1863, he passed over a bank of considerable extent on which he hove to and obtained soundings of 8, 10, and 12 fathoms; also caught several large fish of the rock-cod species. On first seeing the bottom, Hergest Rocks bore 86° about 10 or 12 miles.

In 1870 an American whaler crossed the bank and reported to that effect.

In March, 1871, the schooner *Nautilus* passed over this bank, obtaining soundings of from 4 to 10 fathoms, Hergest Rocks bearing 75° 7 or 8 miles.

Clark Bank was first reported in latitude 8° 18′ S., longitude 139° 52′ W. The French war vessel *Venus* sounded near this position and failed to obtain bottom at 176 fathoms. This bank, however, has been clearly seen from several ships, and the whaler *Spartan* crossed it from north to south in 1855, obtaining 8½ fathoms least depth of water for 2 or 3 miles, though apparently shoaler patches were seen from aloft.

From observations taken from the French schooner *Eugenie*, 1886, Clark Bank is considered to be about 4 miles long north and south by 3 miles east and west, and to lie, approximately, in latitude 8° 18′ S., longitude 139° 40′ W.; the letters PD are still retained on the charts.

Eiao or Masse Island (lat. 8° 00′ S., long. 140° 40′ W.), 56 miles northwestward of Nukuhiva, is 6½ miles in length northeast and southwest and attains a height of 2,000 feet. The southern shores are rocky, without any coves or landing places; the surface, though green, produces no trees, but a few shrubs and bushes are thinly scattered over the face of the rocks. The northwestern side has a more favorable aspect, and although the coast is rocky a number of trees grow both on the sides of the hills and in the valleys. It also possesses some coves where landing is possible, especially in one near the middle; this, from the appearance of the northern side, is named Battery Cove.

A little northward of Battery Cove, at the northwestern extreme of the island, is Vaitahu or Coconut Bay, where good anchorage his been found, with regular soundings of from 5 to 18 fathoms, fine clear sand.

In making for the anchorage in Vaitahu Bay from the northward, care should be taken on account of the eddy currents near the north point of the bay.

Water.—An excellent stream of fresh water discharges into the bay near a grove of coconut trees. The landing is on a sandy beach at the head of the bay, and, though generally good, is sometimes indifferent on account of the surf. Water is easily obtained.

In these two valleys the vegetation seems more luxuriant than in other parts of the island. Besides these, between the peaks are several plateaux covered with pine trees and verdure. The island is not inhabited, but is occasionally visited from Nukuhiva and Ua pu. It appears to have good pasturage, and a considerable head of cattle might easily be maintained on it.

Hatutu or Chanal Island (lat. 7° 56′ S., long. 140° 33′ W.), 3 miles northeastward of Eiao Island, is about 4 miles in length northeast and southwest and 1 mile wide. It attains a height of 1,380 feet. At the northern point is a high pinnacle rock a short distance from the shore, and at the southwestern end rocks extend a short distance. The island has a stunted vegetation in parts, but there is no anchorage anywhere around its shores.

Hatutu affords an abundance of fish and sea fowl, and is occasionally resorted to by the natives of Nukuhiva and Ua pu.

Caution.—The channel separating Hatutu from Eiao is believed to be quite free from danger, but a breaker was once reported to have been seen in mid-channel. Though the passage has been frequently passed through since, no sign of danger has been perceived, but a rock is still marked in this position on the chart.

The current is generally running with some strength to the northwestward through this channel.

Coral islands (lat. 7° 53′ S., long. 140° 23′ W.).—About 9 miles eastward of the eastern end of Hatutu is the westernmost of two small coral islands. These islands are only from 6 to 9 feet above water and are surrounded by a shoal on which the sea breaks heavily.

Caution.—Soundings of from 12 to 30 fathoms extend a long way to the northwestward of the shoal. It is a vicinity to be avoided, as there are vague reports from whalers of other shoals in the neighborhood.

CHAPTER VI.

TONGA OR FRIENDLY, AND SAMOA OR NAVIGATOR ISLANDS, ETC.

Caution.—Soundings obtained from the British surveying vessels *Egeria*, during the years 1888–89, also the *Penguin* and *Waterwitch*, 1895–96, have revealed the presence of very uneven bottom between the Kermadec Group and the Fiji and Tonga Islands; and though no dangers have been discovered, the region immediately southward of the latter group, for the distance of about 250 miles, should be regarded with suspicion.

Wolverene Banks.—Soundings of 37 and 40 fathoms were reported from the British naval vessel *Wolverene* in 1877, in latitude 25° 37′ S., and 25° 24′ S., and in about longitude 179° 4′ W.

Near this position (*Wolverene's*) an extensive bank was found, but a search of nine days over an area of 15 miles north and south, and 10 miles east and west of the shoalest cast, resulted in finding no less water than 204 fathoms.

The bank trends generally north and south, and is probably a shallower part of the ridge that seems to extend from the Tonga to the Kermadec Islands. The 204 fathoms is in latitude 25° 30′ S., longitude 179° 02′ W.

Circumstances were very favorable during the search, but the *Wolverene's* soundings (although being at night with ship under sail they are not above suspicion), will, for the present, be retained on the charts.

Minerva Reefs (lat. 23° 37′ S., long. 179° 00′ W.).—These reefs appear to stand on a submarine plateau which is from 300 to 500 fathoms below the surface of the sea, and which extends about 28 miles in a north-northeast and opposite direction. They are 18 miles apart, and are situated toward the extremes of this plateau, which, except near the reefs, is formed of hard ground with a little broken shells, coral, and volcanic cinders.

South Minerva Reef.—This reef, consisting of two united atoll-formed reefs, extends 4½ miles in an east-northeast and opposite direction. At the junction of the two atolls the reef is about ¾ mile broad, and here depths of 10 to 20 fathoms are found off the reef to the northwest about 500 yards, affording protected anchorage in Herald Bight during the southeast trade wind.

The western atoll, which has a lagoon almost completely cut off from the sea at low water, has large detached blocks of coral lying on the reef on its southwestern side. This reef is awash at half-tide, and at the time of the *Egeria's* visit (1889) might have been landed on at low water.

The two atolls are connected at low water by narrow shallow channels among coral knolls.

The reef of the northern atoll is from 300 to 500 yards broad, bordered on the lagoon side for nearly ¼ mile by knolls of live and dead coral, having channels between them, with a bottom of sand. At low water there is difficulty in approaching the reef in a boat on the lagoon side on account of these knolls, but at high water there is sufficient water over them. There is an entrance about 200 yards in width on the western side of this lagoon.

On the weather or southeast side of the junction of the two atolls there is a collection of blocks of coral thrown up from the edge of the reef; these are just covered at high water and will probably eventually emerge above the level of the sea. The weather or eastern side of the northern atoll is broader than the lee, and very slightly the higher.

The observation spot on the northwest side is in latitude 23° 55′ S., longitude 179° 07′ W.

North Minerva Reef.—This reef, nearly circular in form, is about 3 miles in diameter, with a small opening on its northwestern side, 300 yards in width. The lagoon, except at the edges of the reef, is clear of coral, the bottom being sand and showing a light blue when viewed from aloft.

The reef is awash at half-tide, and the rise being 6 feet it is therefore about 3 feet dry at low water. It is difficult to approach it from the lagoon side on account of the clusters of coral, which extend about 400 yards from the edge, with deep water and sand between them.

No signs of change in the height, width, or shape of the reef could be detected, but the depth of the lagoon has shoaled 2 to 3 fathoms since 1854, and the depth in the entrance is 13 fathoms.

The observation spot, at the north side of the lagoon entrance, is as stated in the margin.

Tides and tidal streams.—It is high water, full and change, at 8h. 0m.; springs rise 6 feet. At the entrance to the lagoon the tide at half-ebb runs north-northwest with a rate about 3 knots. At the ship near the center of the lagoon the flood was found to set southeast by south and the ebb north-northwest from a quarter to a half knot per hour.

Reef.—The British ship *Cardiganshire* reports having passed, on June 20, 1896, a sunken reef, which appeared to be about 200 yards in length. Approximate position, latitude 23° 42′ S., longitude 175° 35′ W.

No soundings were taken, and the existence of a reef in the abovementioned position requires confirmation.

Pelorus Reef was reported in 1861 to be in latitude 22° 52′ 15″ S., longitude 176° 27′ 45″ W., and to be very shallow. The British surveying vessel *Egeria*, 1889, found a bank here and anchored in 19 fathoms. Sounding around the ship in the boats, nothing less than 14 fathoms was found.

A patch of organic matter, which had every appearance of a shoal and was reported at several miles distance from the masthead, was found floating near the shoal water. It is a remarkable coincidence that the *Pelorus* and *Egeria* were both on this spot at the same time of year, the one on the 13th, the other on the 14th of July, and it appears probable that a similar patch of organisms, hatched on the bank, misled the officers making the original report. No sounding was obtained in 1861.

It would be prudent, however, to avoid the Pelorus Bank. The 14 fathoms lies in latitude 22° 51′ S., longitude 176° 26′ W.

Midway between Pelorus Bank and Ata Island there is a bank of 22 fathoms, and a bank with least water of 88 fathoms lies 40 miles eastward of Pelorous Bank.

Ata or Pylstaart Island (lat. 22° 20′ 00″ S., long. 176° 12′ 30″ W.) was discovered in 1643, and named Pylstaart or Tropic-bird Island.

The island is 3 miles long and uninhabited; there is no anchorage off the island, which is well wooded and has coconut palms among other trees.

The north peak is 1,165 feet, and the south peak 1,159 feet in height.

Gleaner Reef.—A reef, upon which the American barkentine *Gleaner* struck, in 1910, when drawing about 17 feet, is reported to be situated in latitude 22° 43′ S., longitude 173° 5′ W., but its position is doubtful.

Tonga or Friendly Islands—Government.—The government is a limited monarchy, the King being assisted by several European officials, a council, and native parliament; and there are governors of Haapai and Vavau. The whole group, including also Niue or Savage Island, is under the protectorate of Great Britain.

Population of the group by census in 1905 amounted to 21,103.

Climate.—The climate is humid and in the summer the heat is great; between April and October the temperature is moderate, and the weather, as a rule, very fine and pleasant.

Earth tremors.—In Tongatabu earth tremors are frequent.

Specimens of the bottom obtained in sounding around the islands show it to be in many places of a volcanic nature; the deep water met with off the east point of Tongatabu, between it and Eua Island, as also at a short distance from the south coast, afford evidence of great volcanic disturbances in the past.

In July, 1907, a volcanic eruption was reported to be in progress 30 miles southwest of the western extreme of Tongatabu; caution is necessary when in this neighborhod and a good lookout kept for any new shoal.

Winds and weather.—Winds from southeast and east-southeast prevail in the vicinity of Tongatabu, but in February, March, and April they frequently blow from west and northwest, accompanied by showers of rain and violent squalls. The heavy southwesterly swell raised by the gales in high southern latitudes is almost continual and keeps up a heavy surf on the southern coast of the island.

Between November and the end of March the weather is often bad. Hurricanes are liable to occur between the above months (one case occurred in May), and are more frequent in the neighborhood of Haapai and Vavau. These storms commence at northwest, then veer to the northward and eastward, and end at southeast; during their continuance the wind frequently changes from one point to its opposite. If the full fury of the storm be felt at Vavau, Tongatabu generally escapes, and vice versa, but Haapai being situated between the two places generally suffers in any case.

Time.—Eastern time and calendar are observed.

Tides.—The tides in the Tongan Archipelago are very regular, both in height and range, the moon's parallax having, however, an unusually large effect on the range. The diurnal inequality amounts to about 6 inches, both at high and low water. The higher tide following the moon's superior transit when the moon's declination is south, and the inferior transit when the declination is north.

Eua Island lies southeastward of Tongatabu, a channel 10 miles in width separating them. The island is 10½ miles long in a north-northwest and opposite direction, and 3 miles broad, and attains a height of 1,078 feet near its southern end; it contains about 350 inhabitants.

There are avenues of coconuts around the island and good grass land supporting large numbers of sheep.

Off the southwestern side of Eua is a small island named Kallau, the channel between them being 2 miles wide.

English Road is situated on the northwest side of Eua Island. The anchorage is in 25 fathoms, about 600 yards distant from the shore, opposite Ohonua, and is unsafe with westerly winds or swell.

Tongatabu (lat. 21° 00′ S., long. 175° 15′ W.).—The chief island of the Tonga Group is Tongatabu, which has nearly the form of a triangle, its base being to the southeast and its apex terminating in a curved narrow horn to the northwest. The extreme length in this direction is 18½ miles, and its greatest breadth in the southeast is 9 miles. It narrows, however, in the northwest to under ½ mile. The formation is coral limestone throughout.

The soil is fertile, loose, and dark in color, mixed in places with a kind of reddish clay.

The surface of the island is for the most part level, but the ground is undulating in places, and rises from the sea level on the north coast to a height of rather over 200 feet in the southeast.

The interior is much broken up by an extensive shallow lagoon, the entrance to which is on the north coast, and is only fit for boats.

The towns Mua and Bea are situated by it, the former on the southeast bank, and the latter near the southwest end.

Niu Aunofo or Van Dieman Point is the northwest extreme of the island; it is a low rocky cliff, with coconut and other trees on it.

From this the coast trends southwestward, almost in a straight line for 2½ miles; it is rocky with long patches of white sand.

A fringing reef extends along it a short distance from the shore, and there is deep water close to it. Tasman is reported to have anchored off this part of the coast, and named it Van Dieman Road. There is, however, nothing worthy of being called an anchorage.

Duff Reef.—About midway along the above coast, and separated from it by a deep channel 2 miles in width, is a small reef, nearly circular in form, on which the sea always breaks heavily. It is only 600 yards in length north and south, and 500 yards east and west. It is steep-to on all sides, but is a formidable danger to vessels when approaching this part of the coast on a dark night.

Coast.—From Niu Aunofo the coast trends south by east for 4 miles, when it curves around east-southeast for 14 miles to Houma Toloa or Cook Point, which is the south extreme of the island.

To within 5 miles of Houma Toloa there is little to attract the eye except a considerable number of blow holes, which are formed by the sea rushing into clefts and holes in a broad ledge of rock, which extends between the higher ground and the coast line.

The latter is mostly low rocky cliff with patches of white sand here and there, and occasional white mounds of coral sand which are native burial places.

At a short distance back from the sea the ground rises from 100 to 120 feet high, trees and scrub being plentiful.

At 5 miles west of Houma Toloa the character of the coast changes, and rises, until at Houma Toloa the cliffs of coral rock are more than 200 feet in height, the ground and trees immediately at the back of them are 270 feet above the sea; this is the most elevated part of the island.

Houma Toloa or Cook Point is rounded and rocky, wooded nearly down to the water's edge, with a fringing reef extending along it, to an average distance of 200 yards.

From here the coast curves inwardly, until at 9 miles northeast by north the east point of the island, Mui Hobohobonga, is reached.

East coast.—The character of this coast line is much the same as on the northwest coast, consisting of low broken cliff, rocky and sand patches.

The fringing reef which surrounds Houma Toloa continues for some distance to the northward, and a similar reef extends around Mui Hobohobonga. On this part of the coast are situated some caves, the entrances to which are 40 to 60 feet above the sea. They contain fine stalactites, and fresh water; the latter was supposed to be of great depth, but on sounding was in no place found to be more than 8 feet. The caves are easily reached from Mui.

The north coast is much broken and is very low, the highest point being a small mound named Bobua or Cooks Hill, elevated 108 feet above the sea (including the wood), which is situated near the coast line, 2 miles eastward of Nukualofa. A similar mound, but without wood, named Mount Zion, 60 feet high, is in Nukualofa.

Coral reefs extend some distance from the shore, and for 9 miles to the northward. Numerous small islands and islets are dotted about on the reef, amid which are the approaches to the chief port and anchorage of the group.

Approaches to Nukualofa.—There are three channels by which Nukualofa may be reached; Lahi, or Great Passage; Biha, or Eastern Passage, and Egeria Channel.

Of these, Biha Channel is the only one recommended for large vessels.

Lahi Passage (lat. 21° 02′ S., long. 175° 12′ W.).—There are a great number of small coral heads in this channel; it can not be considered safe for navigation by any but light-draft vessels, and it is quite possible that rocks exist yet undetected. By following carefully the directions a safe passage will be found in clear weather.

Monro Rock is a small coral head, with 4 fathoms water, situated westward of the approach to Lahi Passage, from which the north end of Atata Island bears 228°, distant 5 miles, and Malinoa 130°.

Hakau Mamao is a coral reef 1,500 yards across, of an oval form, which lies 1,800 yards southwestward of Monro Rock, there being a navigable channel between the two, though foul ground extends northward from the edge of the reef for over 800 yards.

The breakers around the reef are always visible, their north extremity in line with the north end of Atata leads westward of Monro Rock; and the south end of the breakers in line with the north end of Atata leads to the southward of the rock.

The eastern edge of Hakau Mamao may be passed at 600 yards distant in 15 to 16 fathoms, though it is preferable to pass in to the eastward of Monro Rock.

Tufaka is a small, rocky, and wooded islet ½ mile 179° of the south extreme of Atata, and is situated on the reef which is continuous between Atata and Nukualofa.

Atata is a wooded island with low-cliff coast line westward of Lahi Passage. The land and trees rise to 93 feet above the sea, so that it will be seen some distance.

Malinoa is a small and low sandy islet, with a few coconut trees on it, 51 feet high, on the eastern side of Lahi Passage. Detached reefs extend to a distance of 2 miles northwest of it; the westernmost reef breaks, and is situated ¾ mile eastward of the leading mark for entering the pass.

Directions for Lahi Passage.—Approaching from the northwestward, steer in with the northeast extreme of Malinoa in line with Mui Hobohobonga 141°, which leads eastward of Monro Rock, and keep that mark on until the east extreme of Boloa bears 219°, when steer for it on that bearing, until Niu Aunofo is in line with the north extreme of Atata, when steer to the southwestward, and bring a white conical beacon on the foreshore in line with the east extreme of Boloa, bearing 215°, which leads westward of a 2-fathom patch, whence course may be shaped as requisite.

Biha or Eastern Passage.—When approaching Tongatabu from the southward, Eua Island, 1,078 feet high, will, in clear weather, be seen from a considerable distance. The channel between it and Tongatabu is wide and deep; the coast on either hand may be passed at 1 mile distant.

Eastern Passage may be said to commence between the east point of Tongatabu on the south and Nuku and Fukave Islands on the north, where it has a width of rather more than 2½ miles.

Continuous coral reefs extend on either hand, which gradually near one another as Maka haa Island is approached.

Eua iki Island, in the entrance to Bihia Channel, is about 180 feet high. Reefs, which break, extend a considerable distance in an easterly direction from the southeastern side of this island. No vessel should pass the east or south side of this island nearer than 1½ miles. The island was formerly the pilot station, but landing and embarking was so difficult at times that it was discontinued.

About ½ mile from Maka haa Island the passage becomes barely 400 yards across in places, and takes a sharp curve to the northward. This portion is named the Narrows. A leper asylum has been built on Motu Tabu.

Beacons.—An iron-pole beacon is erected on the edge of the reef on the south side of the channel, at 2 miles eastward of Maka haa.

Narrows.—A white beacon, surmounted by an inverted triangle and standing on three concrete piles, is erected on the edge of the reef, at 900 yards southward of Monu afe.

An iron-pole beacon marks the edge of the reef on the north side of the channel, at 400 yards southward of Maka haa, and two similar beacons are situated on the south side of the channel, on the edge of the reef extending northwestward from Pangai motu.

Ulangu lalu.—A white beacon, standing on three concrete piles and surmounted by a square topmark, marks the eastern edge of this reef.

A similar beacon, surmounted by a triangular topmark, marks the western edge of the reef.

Monu Reef—Beacons.—The beacon on the northern edge of this reef has been replaced by a white beacon standing on three concrete piles and surmounted by a triangular topmark.

A similar beacon, surmounted by a square topmark, is erected on the southeastern edge, and a similar beacon, surmounted by an inverted triangle, on the south extreme.

Ulanga uta—Beacons.—The eastern, western, and southern edge of this reef are marked by white beacons standing on three concrete piles.

The eastern beacon is surmounted by a square topmark, the western by a triangle, and the southern by an inverted triangle.

Directions.—Approaching the eastern passage the east point of Tongatabu may be rounded at from ½ mile to 1 mile distant, by standing to the northwestward till the north end of Eua iki Island bears 93°, when the course should be altered to 273°, with the north end of Eua iki astern, and when Malinoa Island is over the eastern end of Onevai bearing 338°, bring the church on Mount Zion (a white building without a spire and situated on a green mound) midway between Pangaimotu and Maka haa Islands, bearing 254°, to which the course should now be altered, and the church kept midway between the two, until the Narrows open.

In a long vessel it is better to bring the church a little nearer to Pangaimotu than Maka haa, which will give more room to turn into the Narrows, but care must be taken to keep it well open of the north end of the former island.

The above course will clear the south extreme of the reef on the northern side of the fairway, which projects to the southward in a tongue shape from the main line of reef, and narrows the passage here to 600 yards.

The Narrows.—A dangerous rocky patch which lies in the southeast portion of the Narrows at 250 yards from the main reef, is marked by a red conical buoy. A black cask buoy marks the edge of Maka haa Reef, at the northern part of the Narrows.

The buoys are frequently washed away.

Entering through the Narrows.—The church on Mount Zion should be kept between Pangaimotu and Maka haa, as previously directed, until the west end of Monu afe is in line with the west extreme of Velitoa, bearing 5°, when the tongue projecting from the northern reef will have been left on the starboard hand.

The course should now be altered for the pilot station flagstaff, and continued for about 400 yards. When the west end of Monu afe is in line with the east end of Velitoa, bearing 20°, the east extreme of Fafa will be seen bearing about 339°; the course may be sharply altered for this, passing between the red buoy on the starboard hand at rather over 200 yards, and the black buoy on the port hand.

After passing the black buoy, at about 200 yards, the course may be altered for the west end of Fafa, and so continued until the north extreme of Monu afe comes in line with the south extreme of Motu tabu, bearing 82°.

This leading mark for clearing foul ground to the northward, and Alert Shoal, to the southward, should be kept on until the church on Mount Zion bears 237°, when a course may be steered for it. Pass northward of the beacon on Monu Reef, to the anchorage.

Mount Zion Church is obscured by trees from the eastern part of Biha, but the government flagstaff, near the root of the jetty, is conspicuous, and affords an alternative mark.

Tidal streams.—Observations made in Eastern Passage show that the flood or rising tide sets to the westward and the ebb or falling tide to the eastward.

Caution.—The streams run strongly in the Narrows, and in consequence of the sharp turn, do not set fairly through; care must be taken in watching the vessel. The tidal streams have been reported as irregular in this channel. The maximum rate is probably 3 knots.

Heavy tide rips and overfalls are often met with just eastward of the Narrows, during spring tides, and in high winds.

Reefs in the anchorage.—**Ulangu lalu**, a reef, about ½ mile in diameter and which dries from 2 to 3 feet at low water, lies on the north side of the channel leading from the Narrows to Nukualofa, and 1¾ miles northward of the jetty at Nukualofa.

Monu Reef lies northeastward of the town and has a clear passage between it and the shore reef, 400 yards wide in its narrowest part. It is nearly circular, and rather more than 800 yards in diameter.

A small white cone-shaped beacon on an iron staff stands on the northern edge of the Monu Reef; if kept in line with Zion Church 237°, will clear the Alert Shoal.

Ulanga uta, about ½ mile northwestward of Monu, is also nearly circular and dries 2 to 3 feet; it lies 1,800 yards 10° of Mount Zion. and is only 400 yards across.

Maria Bay, so called by Tasman, in the western approach to Egerie Channel, is sheltered from the sea caused by north winds to a great extent by patches of reef, which, in a way, form continuation of the horn extending from Niu Aunofo, and between which are deep passages leading into the bay. It affords anchorage westward of Atata in 6 to 12 fathoms; also in other parts of it.

Egeria Channel was frequently used by the vessel of that name when the survey was made (1889). It is, however, narrow, and the passage is rendered more so by the existence of rocks.

Its chief advantages lie in the fact that the tidal streams set fairly through it, that the distance passing through the reefs is little more than 1 mile, and that there are greater facilities for fixing a vessel's position. This channel should not be used by vessels of more than 20 feet draft, although the least depth is reported to be 5 fathoms at low water springs.

Buoyage.—The narrows of Egeria Channel is marked by three black barrel buoys on the nortrern side and three red conical buoys on the edge of the reef on the southern side. Two of the black buoys mark Johnnie Shoal and Friday Shoal, respectively.

Wreck.—A wreck of the steamer *Knight of St. George* lies on the northern edge of the reef forming the north side of Egeria Channel, at 1,800 yards northward of Atata Island.

Directions.—For vessels of 20 feet draft and less, approaching Tongatabu anywhere from the westward, Egeria Channel offers a great saving of distance, and it has the advantage of being available when the weather might be too thick to enable any of the islands to be seen.

The horn which forms Niu Aunofo Point, the northwestern extreme of Tongatabu, has before been alluded to, and it incloses a considerable amount of coral reef inside its curve to the eastward.

There are four openings between the patches leading into Maria Bay, the approach to Egeria Channel, the two western are encumbered with foul ground, but the two eastern openings are clear.

When approaching Maria Bay, the seaward edge of these reefs may be passed at ½ mile, and as the sea is always breaking on them, and they are steep-to, this is an advantage in thick weather.

For entering the bay, stand alongside the seaward edge, until the south extreme of Atata bears 135°, which being steered for will lead through the eastern of the four openings, in 12 to 14 fathoms; the passage is 700 yards wide between the reefs.

When within the reefs, which will be known by the breakers, to approach Egeria Channel, alter course 76°, when the edge of the reef off the north end of Atata will be seen, and the course may be altered to round the north end of Atata at 500 yards distant, between it and the 2 fathoms patch situated with the east extreme of Atata bearing 181° distant 1,100 yards, and marked by a red and black conical buoy.

Two rocks, named respectively Friday and Johnnie, narrow the channel at its southern end to 400 yards; they are close together, and their positions are each marked: Friday by a black conical buoy; Johnnie by a black barrel buoy; both of which must be left on the port hand at 200 yards distant.

When Niu Aunofo shuts in behind the north end of Atata, the southernmost of the two rocks will be passed, thence course should be shaped to pass eastward of Campbell Rock red buoy and for Nukualofa.

Campbell Rock comprises small coral heads with 3 and 4 fathoms on them respectively.

The south end of Atata in line with Niu Aunofo leads northward of it, and the north end of Tufaka in line with Niu Aunofo leads to the southward.

It lies directly on the line between the south part of Egeria Channel and Nukualofa, and is marked by a conical red buoy.

Danger angle.—An angle of 64° between the left extreme of Tufaka and the right extreme of Atata, leads 250 yards eastward of Campbell Rock, and passes westward of Friday and Johnnie Rocks in Egeria Channel.

After passing Campbell Rock a course may be steered for the anchorage, bearing in mind Ulanga uta, 1,800 yards 10°, of the church on Mount Zion.

Caution.—The buoys in Tongatabu should not be implicitly relied upon.

Tidal streams.—The flood or rising tide sets to the westward in Egeria Channel, and the ebb or falling to the eastward. Both streams run in the direction of the channel.

Nukualofa, the most important place on Tongatabu, is situated on the north side, and here reside the King, his Government officials, the foreign consuls, etc.

The King's palace with the royal chapel close-to are conspicuous buildings of wood, situated near the sea.

The Government offices, port office, etc., are also of wood, and stretch in a line parallel to the coast, eastward of the palace.

Position.—The observation spot near the Tongan flagstaff is in latitude 21° 07′ 53″ S., longitude 175° 12′ 15″ W.

Jetty.—A causeway built of coral has been carried out to the edge of the reef in front of the Government buildings, having at the end a jetty on wooden piles, with 23 feet of water alongside. Length of berth is 200 feet. The jetty in 1905 was reported to be in unsound condition and not safe to lie alongside during a blow.

With winds from the northward there is at times a loppy sea, so that it is always advisable to let go an anchor in that direction, by which to haul off if necessary.

A tramway runs down to the jetty. The Government sheds stand on either side at the inshore end of the causeway.

Lights.—A fixed white light, visible 7 miles, is shown from the end of the jetty, and a fixed red light on the T pierhead.

Supplies.—Fish abound in the harbor. The natives, however, seldom bring any alongside.

Beef may be obtained usually once a week. Bread from Messrs. Cowley.

Mutton of good quality is obtainable daily, the sheep being sent across from Eua Island.

Fowls may be obtained in small quantities, and vegetables fairly often.

Water, none obtainable.

Anchorages.—The anchorage for large vessels is southward and eastward of Ulanga uta, the northwestern reef in the anchorage.

A snug berth for a small vessel is with the turret of the palace in line with the east extreme of the jetty, midway between the latter and Monu Reef.

The bottom is composed of coral patches, between which is sand, and, in some cases, mud.

In the summer months (between November and April, which is also the hurricane season) more shelter and better holding ground will be found southwestward of Pangaimotu in the eastern bight of Nukualofa Harbor.

Tides.—It is high water, full and change, at 7h. 0m.; springs rise from 4¾ to 5¾ feet, neaps 3 to 4¾ feet.

Two tides of unequal range occur in the 24 hours in the following order: Highest high water, lowest low water, lesser high water, higher low water.

The low water ordinary springs is 9 feet 9½ inches below the bench mark on the western face of the pedestal of the statue of Prince Wellington.

Pilot station.—The pilot station is situated on Maka haa Island, in the Narrows of the eastern channel. It is marked by a flagstaff, from which the approach of a vessel is signaled to Nukualofa.

One pilot is stationed at Maka haa, with a boat and boat's crew; he boards all vessels entering the harbor and takes them to the anchorage.

Another pilot is on shore at Nukualofa and is available for taking vessels from the anchorage to sea.

When a vessel enters Nukualofa by Biha Channel, the pilot from Maka haa will meet her in plenty of time to take her through the

Narrows, if wanted to do so. Those entering by Egeria Channel will often have to do so without a pilot.

Shoals—Dido Shoal.—The shoalest parts of this danger consist of two patches, each having 4 fathoms over it, and lying, respectively, 7°, distant 6.3 miles, and 353°, distant 5¾ miles from Tau Island and about 13 miles northward of the east extreme of Tongatabu.

Hyane Shoal, a small coral patch with 4 fathoms over it, lies westward of Dido Shoal and 6 miles 16° from Malinoa Island.

Another patch, with 4 fathoms over it, lies 6¾ miles 26° from Malinoa Island.

Honga Hapai Island, lying 31 miles 353° from the northwest point of Tongatabu Island, is flat-topped and about 400 feet high. Hongo Tonga Island , 2 miles northeast of Hongo Hapai, is peaked and about 490 feet high. Smoke was seen many years ago issuing from the sea about 6 miles northward of this island.

A reef that breaks lies about 2 miles southeastward of Honga Hapai.

Caution.—When navigating this part of the group allowance must be made for the current which sets strongly to the westward.

Submarine volcanoes.—An active submerged volcano, over which a depth of 40 fathoms was found, was reported in 1911 by the British naval vessel *Torch* to be situated 19 miles northwestward of the northwestern extreme of Tongatabu.

A submarine volcano, emitting continuous steam and smoke and intermittent volumes of water, was reported in 1912 by the steamer *Tofua* to be situated about 2 miles southeastward of Honga Haapai Island.

Falcon Island has undergone so many changes that a history of it is here preserved, for it may prove of great interest in the future. This volcanic island was first seen as a breaking reef from the British naval vessel *Falcon*, 1865; again in 1877 smoke was seen issuing from the sea from the British naval vessel *Sappho;* it appeared in October, 1885, and in October, 1889, was surveyed from the British surveying vessel *Egeria.*

It was found to be 1¼ miles long north and south, and 1 mile wide, shaped like a wedge, the highest part 153 feet above the sea, being on the southern end. It was formed of loose volcanic ashes and cinders, which material was constantly slipping down, as the action of the sea undermined the coast, and it then dispersed. It was estimated that two-thirds of the island had been washed away since 1885. No growing coral was found.

The observation spot on the northwest side was found to be in latitude 20° 18′ 42″ S., longitude 175° 25′ 15″ W., since disappeared.

The *Egeria* was anchored on the southwest side of the island in 20 fathoms, also on the west and north sides, according to the wind.

In April, 1894, Falcon Island had washed away to such an extent that at a distance of 2 miles it had the appearance of a low streak of black rock, which could not be seen at night.

On December 21, 1894, volcanic action was found to have quite recently taken place at Falcon Island, by which a new crater had been formed, with the result that the island was then 50 feet high, 3 miles long, and 1½ miles broad, the surface being still quite hot.

In July, 1898, Falcon Island had disappeared and its place occupied by a shoal about 100 yards in extent, breaking heavily. Discolored water from ½ to ¼ mile in extent was also seen about 1 mile southward of these breakers.

In April, 1900, the shoal to which Falcon Island had been reduced was showing above water at its northern end.

Discolored water.—Much green water, having the appearance of shoals, was met with between Tongatabu and Falcon Island, but, on sounding in it, deep water was found, and the sea contained minute particles of volcanic matter.

Nomuka Group.—Nomuka Island, the principal island of this group, is of coral formation and in the form of an equilateral triangle, the sides of which are 2 miles in length, inclosing a salt-water lagoon ¾ mile in diameter. On the west side of the lagoon is a ridge, the north and south extremes of which form peaks 166 and 162 feet high, respectively.

A narrow coral reef fringes the island, but has breaks in it where boats can approach the shore. A village is situated on the southwest side and has good landing for boats opposite it.

The island is well cultivated, principally with coconut trees. No water is procurable, and provisions are scarce, only a few fowls or pigs being obtainable.

Nomuka Harbor lies between Nomuka Island on the north and Nomuka iki on the south, and, except to the northwest, is well protected by the above-mentioned islands and adjoining reefs.

The best anchorage is immediately north of Nomuka iki and between it and Lua va ila Reef, in 12 to 14 fathoms, coral sand, with the north point of Nomuka iki bearing 246° and the east extreme 162°, about 700 yards from the shore.

Nomuka iki lies about 1 mile southwest by south of Nomuka. It is 1 mile in length northwest and southeast and 700 yards in breadth. The southern and highest part is composed of volcanic and sedimentary deposits and rises to a height of 147 feet.

A convict settlement has been established here, the prisoners being made to work on the plantations.

Coral reefs surround this island, extending off the south point ½ mile and then turning eastward for 1 mile. Two sand cays are situated on this extension to the eastward.

Several detached reefs and foul ground lie southwest and west as far as examined.

Mui fuiva is an islet 10 feet high, with some coconuts on it, lying ½ mile northwestward of Nomuka iki, and is conspicuous when approaching the harbor from the westward.

North of this island, and between it and Nomuka, are two coral patches with depths of 4½ and 5 fathoms, respectively. Another coral patch, with 7 fathoms on it, lies nearer Mui fuiva. North of the most northern of these shoals there is a clear passage to the harbor 400 yards broad.

Directions.—When proceeding to the harbor by the western entrance, steer 88° for the south peak of Nomuka until the western point of Nomuka iki bears 162°, then alter course for the anchorage. With the sun astern, a vessel may be navigated between the shoals from the masthead.

Tide and tidal streams.—It is high water, full and change, at Nomuka at 7h. 15m.; springs rise from 3 feet 6 inches to 4 feet 9 inches; neaps 3 feet to 4 feet. At the anchorage the flood stream sets west-northwest, the ebb east-southeast.

Position.—The summit of the sea beach, south of the burial ground at Nomuka, was found to be in latitude 20° 15′ 36″ S. and longitude 174° 48′ 5″ W.

Islets and reefs.—Only the principal islets and reefs are here mentioned; for the many others, see the chart.

Mango iki is an islet situated 5½ miles 134° from the southern mound of Nomuka; it is 68 feet high to the tops of the trees, about 200 yards in extent, and surrounded by a breaking reef.

Mango Island lies 1 mile eastward of Mango iki, is 1 mile in length and 800 yards in width. The two mounds at its western and eastern ends are respectively 139 and 141 feet in height, and wooded. The village is on the north coast; it contains about 50 inhabitants, and there is a good landing opposite the church. There is also a good boat harbor about 400 yards eastward of the church.

Between Mango and Mango iki the passage is bad, especially during southerly winds.

Nukufaiau Islet, about 6½ miles southeast by east of Nomuka, is a low islet which had a prominent coconut tree in the southern part 58 feet in height; it is surrounded by a reef for 400 yards distant.

A coral patch extends about 150 yards in extent with a depth of 3½ fathoms and 18 fathoms around, lies with Nukufaiau bearing 114° distant nearly 2 miles.

Nukutula is a vegetated sand bank, 18 feet high, standing on a reef 5 miles eastward of Nomuka. Meama Islet at 2¾ miles 111° from Nukutula is a reef islet with a straggling cluster of coconut trees 93 feet in height.

Fonoifua Island lies 8 miles eastward of Nomuka. It is low; rising to a cliff 67 feet high on the north coast; to the tops of the trees it is 93 feet high. There is a small village in the center of the south coast, where there is a boat landing through the reef.

Tanoa Islet is 1 mile southward of Fonoifua, has clumps of coconuts, and is 57 feet high. There is a good boat harbor in the reef northward of the island.

Otu tolu Islands all stand on the same sunken reef about 15 miles eastward of Nomuka; they comprise four islands, low, wooded, even-topped, and are uninhabited. Pumice is scattered over the surface. There is no fresh water, but fish are plentiful off the reefs.

Fetokopunga is the northernmost of the Otu tolu Group, 57 feet high, and has no distinguishing feature. Telekivavau, about 1 mile further southward, is 71 feet high. Lalona, the next islet, about 2 miles further south, is 67 feet high and has a good landing at the northern end. Telekitonga, the southernmost, is 53 feet high, and has a good landing northward of its southwest extreme.

Caution.—The area inclosed between the reefs south of the Otu tolu, Nomuka, and the islands to the southward, are thickly studded with reefs and shoals, and it is unsuitable for navigation except under favorable circumstances of light. The reefs are steep-to and not easily seen, even from the masthead. There are, however, passages that can be made use of if necessary, but great caution should be exercised.

The currents, especially in the vicinity of the reefs, are uncertain in strength and variable in direction. After strong easterly winds they set strongly to the westward, causing rips and blind rollers in places.

Tonumeia lies 12 miles 179° from Nomuka, is 138 feet high, and densely wooded. There is landing, except in northerly winds, through a break in the reef on the north side. Water of inferior quality and small in quantity can be obtained from a well about half-way along the cliff on the northwest side. Kefikana Rock, 13 feet high, white and conspicuous when the sun is shining on it, lies 1 mile 224° from this island.

Nuku Islets lie next southward of Tonumeia; each has one or more coconut trees near the center.

Kelefesia Island, the southernmost of the Nomuka Group, lies 3 miles 156° from Tonumeia; it is 1,200 yards long northwest and southeast, 400 yards broad, 123 feet in height, and wooded. There is no safe passage between these islands.

Hakaufisi Reef is the native name for the reef situated about 8 miles northwestward of Nomuka Island. It is about 2 miles long by from 100 to 1,000 yards in breadth, steep-to, partly dry at low water, and always breaks.

Haapai Group—General remarks.—This group is composed of numerous small coral islands, scattered over a space of 40 miles in length in a north-northeast and opposite direction, 22 miles in breadth.

It stands for the most part upon a bank very irregular in shape, within the 100-fathom limit; many of the islands and reefs rise abruptly from deep water with depths of over 200 fathoms around them.

Anchorages are few in number, especially in the northern part of the group.

The principal port in this group is that of Lifuka, which is the port of call for the steamers plying monthly from Auckland and Sydney. It is not a port of entry, and vessels must get pratique at Nukualofa, where the medical officer of the Tongan Group resides.

The population of the group is estimated at 4,500 (1899).

The Haapai Group is fronted by a barrier reef on the southeastern side, through which there are two passages, one only of which, the southern, is navigable for vessels, and through which the tide runs with great strength.

On the southern side the barrier reef is broken up into patches, over some of which the sea breaks heavily, and over others there are blind rollers breaking occasionally.

The only passage into the group from this direction that it is advisable for a vessel to attempt is Ava Fonuaika, lying immediately to the westward of Fonuaika Islet.

Most of the islands of this group present similar features; from a distance they appear low and flat topped, and on a nearer approach a white sandy beach is seen encircling a densely wooded island, entirely surrounded by reef. The principal exceptions are Fotuhaa, Lofanga, and Moungaone Islands, which are of a different character, standing higher with a bold coast line and encircled by little or no reef.

Shoal.—Information from the Tongan mission states that there is an apparently well-founded native report that a shoal exists southeastward of Uiha, Haapi Group, and between 30 and 40 miles distant therefrom.

As this locality has not been examined, a shoal, marked PD, has been placed on the charts in latitude 20° 23′ S., longitude 174° 03′ W.

Southern portion of the group.—**Kotu Group** comprises a cluster of small low islands forming the southwestern part of the Haapai Group. The principal islands forming the group are Oua, Tongua, Kotu, and Haafeva, all of which are inhabited.

There are no good anchorages in the group, the water off the islands being generally from 30 to 40 fathoms deep.

Fonuaika Islet, the southernmost of the group is situated upon a line of detached reefs and shoal patches which extend in an 111° direction for 11½ miles to the southeastern extremity of the solid barrier reef fronting the southeastern side of the group; and which there takes a northerly direction. The island is small and wooded, the tops of the trees being 65 feet high. It is encircled by reef, which on the western side projects to a distance of 400 yards. This edge is steep-to within a short distance, and the sea breaks upon it heavily.

Tokulu is a small sand cay with some bushes upon it, about 15 feet high, situated 5 miles 274° from Fonuaika Island, and is the southwesternmost islet of the group. It stands upon a detached reef around which the 100-fathom line closely skirts its southwestern side.

Oua Island, the southeasternmost of the Kotu Group, lies 4¼ miles 16° from Fonuaika. It is about ¾ mile in extent and densely wooded, the tops of the trees being 140 feet above high water. It has a bold coast line and is the only island in the Haapai Group that produces oranges and is inhabited. It is surrounded by an extensive reef rendering a near approach to it difficult. Some small islets extend in a 246° direction from it to a distance of 1¼ miles, and are connected by a sort of natural causeway which is only just awash at high water and considerably higher than the remainder of the reef. A bight in the reef running in toward these islets forms the easiest approach to Oua.

Lekaleka Islet stands on the eastern end of the above-mentioned extensive reef and is situated 4 miles eastward from Oua Island. It has a somewhat conspicuous clump of coconut trees 60 feet high on the western end; is 800 yards long, east and west, and very narrow. Eastward of Lekaleka Island, reef and shoal patches abound to the inner edge of the barrier reef.

The northern side of the reef between Oua and Lekaleka Islands has several offlying rocks and patches extending to a distance of about 1 miles from the edge of the reef inside the 20-fathom line.

Alexander Reef.—The western end of this reef lies 2 miles southeastward from Lekaleka Islet, and extends in an easterly direction for 2 miles; from thence eastward to the barrier reef the space is occupied by numerous detached reefs and foul ground.

Ava Bubu is the channel between Alexander Reef and the detached reefs extending to the southeastward from Lekaleka Island. It is nearly ¾ mile wide, but as there is no object to be gained by its use, and leads moreover to the vicinity of an extensive area of foul ground which was not sufficiently examined to insure there being no more dangers than those indicated on the chart, it is best avoided; any further description is therefore unnecessary.

Wickham Reef, northward of Murray Patches, extends from 1½ miles to 4½ miles northwest by west from Fonuaika Island. About

¾ mile southward of the eastern end of this reef there is another small detached reef that breaks. Between Wickham Reef and Fonuaika Island, and about 1 mile from the latter, there is a shoal patch with little water on it, and northward of this patch for nearly 1½ miles there are a great number of small coral heads lying within or just on the edge of the 20-fathom line extending from the east and northeast from Wickham Reef.

Ward Rock is a coral patch with less than 6 feet water on it, lying 1.9 miles north of Fouaika Island, with from 38 to 48 fathoms around it.

Clearing marks.—The western extreme of Fakahigu Islet in line with the east extreme of Ono iki Islet bearing 4°, leads 400 yards eastward of the reefs lying northeast of Wickham Reef and 400 yards westward of the edge of the reef extending off Fonuaika Islet.

The east extreme of Tongua Island just open to the northward of Nukulai Islet, bearing 325° leads close northward of these coral heads.

The northeast extreme of Nukulai Islet touching the southwest extreme of Tongua Island bearing 310° leads close southward of Ward Rock.

Doyland Reef is awash, about 670 yards in extent, situated 1½ miles 274° from Nukulai Islet, and midway between the northwest end of Wickham Reef and the southeast extremity of the reef projecting from Tongua Island, leaving a channel ½ mile wide to the southward of the latter. The passage between Doyland and Wickham Reefs is obstructed by a 3-fathom patch near the center.

There is a reef awash midway between Doyland Reef and Nukulai Islet with deep water all round it.

Nukulai is a small wooded islet encircled by reef to a distance of 200 yards to 400 yards, situated 2¾ miles west by south from Oua Island. It is separated by a deep channel 800 yards wide from the westernmost of the small detached coral reefs, which extend from the southwestern extremity of the reef upon which Oua Island stands.

Tongua Island, nearly circular in shape and ¾ mile in diameter, with a bold coastline on its southwestern side, is inhabited and is flat topped and wooded, the tops of the trees being 120 feet above the sea; standing upon a reef that projects to a distance of about 1 mile in a southeasterly direction, and lying 4¼ miles westward of Oua Island.

Lutu egi is the name of a flat-topped rock, 8 feet high, with an arch right through it, lying nearly ½ mile north of Tongua Island.

Foua is a small rocky islet 30 feet high, with trees upon it, situated 1.1 miles northeast by east from Tongua Island.

Rocks.—At 900 yards 21° from this islet there is a rock with less than 6 feet water on it. There is also another coral head lying midway between the islet and Tongua Island, and two more coral heads 292° and 316° distant 500 and 800 yards, respectively.

Luanamu is a small wooded islet 75 feet high, lying midway between Foua and Oua Islands, situated 1¾ miles southeast by east from the former. It stands on the southern end of a detached reef fronting the western end of the reef on which Oua Island stands. The channel between Foua and Luanamu Islets is deep and clear of dangers.

Kito is a small wooded islet 60 feet high lying 1¼ miles northwestward from Tongua Island. Reef projects from it in a southerly direction for nearly 800 yards.

Russell Reef is a small reef awash lying 1½ miles 78° of Kito Islet.

Trerise Patch, with 5 fathoms on it, lies just inside the 100-fathom line 1¾ miles 263° from Kito Islet.

Ava Fonuaika—Directions.—Ava Fonuaika is the best channel by which to approach the Kotu group from the southward. The marks are good and readily distinguished. The channel lies immediately to the westward of Fonuaika Island, to the southward of Ward Rock, and eastward of Nukulai Islet. The channel to the westward of that islet is, however, equally good.

With Fonuaika Island bearing 38° and about 2½ miles distant, steer for the east extreme of Oua Island on a bearing 28°, which will lead to the fairway at 600 yards westward of the reef stretching off Fonuaika Island. When the northeast extreme of Tongua Island shows to the northward of Nukulai Islet bring the center of those islands in line bearing 319°, and steer for them on that bearing, between Ward Rock and the patches northeastward of Wickham Reef.

When the western extreme of Ono iki is in line with the western extreme of Luanamu, bearing 15°, alter course to 10° to pass 400 yards eastward of the reef extending from Nukulai Islet, and the same distance westward of the outermost small coral reef on the eastern side of the channel.

If preferring to pass to the westward of Nukulai Islet, steer to pass about ½ mile to the southward of that islet, until Foua Rock is seen in line with the eastern extreme of Matugu Island, bearing 1°, which leads nearly midway between the reef projecting from Nukulai Islet and the small detached reef lying 1,400 yards westward of it.

Kotu is the western islet of the Kotu Group. It is 1,200 yards in length north and south by about ¼ mile in breadth, and lies nearly 4 miles northwestward from Tongua Island. It is inhabited, densely wooded, and flat topped, the tops of the trees being 120 feet high; the southern end presents to view reddish colored cliffs 50 feet high where they are exposed, while the northern portion is low with a sandy coast line.

An extensive mass of reef and foul ground extends east by north from the island to a distance of nearly 3 miles, leaving a deep channel ¾ mile wide between the eastern end of this reef and the western side of the reef fronting the northwestern side of Haafeva Island.

Pudupudua is a sand cay with a few bushes on it, 12 feet high, standing on a reef 3 miles northeastward of Kotu Island. It is the northernmost of the Kotu group of reefs and islets, and the 100 fathoms line encircling the group extends in a horn 2 miles to the northward of it.

Haafeva Island is the largest and principal island of the Kotu Group, and is the residence of some white traders. It is visited occasionally by the steamers from Auckland and Sydney. The island is nearly 1¼ miles long north and south by about half that in breath; flat topped and wooded, the tops of the trees being 100 feet high, and has a sandy coast line throughout. It is fringed by a narrow reef through which, on the eastern side where the village and the traders' houses are situated, there is a boat channel leading up to the beach. A barrier reef fronts the northwest, north, and northeast sides. The southeastern extremity of this barrier reef lies 1.6 miles 94° from the south point of the island.

Koro is a small rocky islet 50 feet high, with trees upon it, standing on the inner edge of the barrier reef ¾ mile from its southeastern extremity, and the same distance eastward of Haafeva Island.

Ono iki is a small islet with rocky coast line, covered with coconut trees 125 feet high, lying ¾ mile eastward from the southern end of Haafeva Island. No reef surrounds this islet, which is steep-to within a short distance all around.

Letteo is the name of a small flat rock 12 feet high 600 yards 66° from Ono iki Islet. Shoal water extends about 100 yards from the rock.

Fetoa is a rocky islet 670 yards in extent, covered with trees and coconuts 125 feet high, lying 1,200 yards 223° from Haafeva Island with a deep channel between.

Teauba is a rocky islet ½ mile long north and south, 125 feet high, covered with trees and coconuts except on the narrow rocky ledge forming its southern extremity, which is barren. Reefs project to a distance of 100 to 200 yards on its northern and southwestern sides, and it lies southwestward of Fetoa, from which it is separated by a deep channel ½ mile wide.

Channel.—There is a broad clear channel through the Kotu Group from the westward with the southern extreme of Teauba Islet bearing 94°, which leads between Kopau Reef and Trerise Patch, passing 1,200 yards southward of the reef encircling Kotu Island and ½ mile northward of Russell Reef, after passing which the southern end of

Teaubu Islet may be rounded at a distance of ½ mile, avoiding the rock already mentioned that exists ½ mile northward of Foua.

Matugu Island, upon which there is a village, is flat topped and wooded, 100 feet in height. It is of small extent, with a sandy coast line and some reddish cliffs on its eastern end; it lies 1,700 yards westward from Fetoa Islet with deep water between.

A tongue of reef projects in a southwest direction for 670 yards from the southwestern end of the island, and a rocky spit runs in a 27° direction from the northeast end, terminating in a coral patch that dries at low water upward of ½ mile from the shore.

Murray Patches.—The 100-fathom line closely skirting Tokulu passes 2 miles southward of Fonuaika Island. These patches, three in number, separated from each other by deep water, extend for 1¼ miles in a northwest and southeast direction near the 100-fathom line. The northern patch, on which are two coral heads with less than 6 feet water on them, lies from 1.8 to 2.1 miles 120° from Tokulu, and the southern patch, with 6 fathoms on it, lies nearly 3 miles 128° from Tokulu with western extreme of Fonuaika in line with the western extreme of Lekaleka, bearing 63°.

At 3 miles eastward of these patches close to the 100-fathom line, with Fonuaika bearing 344°, distant 1¾ miles, there is another shoal patch with breakers on it. Between the Murray patches and this shoal the approach to Fonuaika Island from the southward is clear of danger.

Hakau Kopau forms the westernmost danger of the Kotu Group. Its center lies 1¼ miles westward from the north point of Kotu Island and is a narrow reef upon which the sea breaks heavily, 2½ miles in length, in a 21° and 201° direction, just within the 100-fathom line. There is a deep passage 1,200 yards broad between this reef and the reef bordering Kotu Island.

Lord Shoal is a coral patch about 400 yards in extent, with from 1 to 2 fathoms water, with its center lying over ¼ mile 105° from Ono iki Islet. If the light is at all good, it can always be seen from aloft. There is a passage 670 yards wide northward of this shoal, between it and the southeastern horn of the barrier reef eastward of Haafeva Island.

Haafeva Anchorage—Directions.—To approach the anchorage on the eastern side of Haafeva Island bring the south point of that island in line with the north point of Kotu Island, bearing 280°, when Letteo Rock will be seen also nearly in line. This mark leads about 250 yards southward of the horn of the barrier reef. When Koro bears 347° alter course to round Letteo at a distance of ¼ mile and anchor off the village in 27 fathoms, sand and coral bottom, with northeast extreme of Haafeva Island touching the eastern extreme of Fotuhaa Island 355° and the southern extreme of Haafeva in line with the northern extreme of Matugu Island, bearing 271°.

Lu Lelau is a small breaking reef situated 2¾ miles 114° from Ono iki Islet and is always plainly distinguishable. It rises from depths of from 30 to 40 fathoms within ½ mile of it on all sides.

Britten Reef, southeastward of Lu Lelau, is a small reef awash, situated nearly 3 miles 1° from the western end of Lekaleka Island.

At 1½ miles 292° and at 2 miles 268° from Britten Reef there are patches of 1½ and 2 fathoms, respectively, and eastward of Britten Reef to a distance of 2½ miles there are numerous shoal patches with but little water on them.

There is no inducement, however, for any vessel to navigate this part of the group, and any detailed description of its dangers is unnecessary.

Southeastern islands and reefs.—Limu Islet is a small wooded cay with trees 40 feet high standing on the barrier reef 9 miles northward of its southeastern extremity.

From Limu Islet the barrier reef trends 319° for 3¼ miles to Ava Mata Mata Vika.

Uanukuhihifu, Uanukuhahaki, and Tofonga are three narrow, wooded islets from 40 to 50 feet high on the barrier reef on the north side of Ava Mata Mata Vika. They occupy a space of 2¼ miles extending in an east-northeast direction from the southwest extreme of the reef.

Uiha Island lies on the continuation of the barrier reef 3.3 miles 46° from Tofonga and is 2¼ miles in length in a 44° and opposite direction by nearly ¾ mile in breadth. From its northeastern point, which is a low cliff of upraised coral, the northern coast assumes a west-northwest direction for 1¼ miles, where it joins the western coast in a low sharp sandy point. There are two villages on the western side of the island, which is covered with thick brush and coconut trees, the tops of the trees being from 90 to 100 feet high.

Tatafa Island, seperated from Uiha Island by a distance of little more than 200 yards, is a narrow wooded island 1,800 yards long, 90 feet high, extending in a 314° direction from the northwest point of Uiha Island. It forms the south side of the entrance to Ava Ahanga Mea.

Channel.—Ava Mata Mata Vika is the channel through the barrier reef lying immediately to the southward of Uanukuhihifu Islet previously mentioned. It is 1,200 yards wide between the edges of the reefs on each side, and has depths of 30 to 35 fathoms in the center.

The tides run through at the rate of 4 to 5 knots; flood to the eastward and ebb to the westward. On the flood tide with an easterly wind there are very heavy tide rips and overfalls, dangerous to boats, but by keeping close to the reef on the southern side they may be avoided to some extent.

Caution.—It is not advisable for vessels to use the passage except near slack water, when it is quite safe. It is slack water at about half tide by the shore.

Moulton Shoals.—Southwestward of Ava Mata Mata Vika there is a bank 2½ miles in length within the 20-fathom limits running in a west-northwest and opposite direction. A narrow ridge of shallow water, with from 1 to 3 fathoms on it, 1,200 yards long, occupies the center of this bank. The northwestern end of this shoal ridge lies 246°, distant 1.9 miles from Uanukuhihifu Islet, and on the northern edge of the bank there is a 5-fathom patch, situated 257°, distant 1½ miles from Uanukuhihifu Islet. A rock with less than 6 feet water lies near the southeast extreme of the bank.

Hakau Fatumanonge Reef is a small reef awash, with deep water all around it lying to the eastward of Moulton Shoals, and situated 1.2 miles 224° from Uanukuhihifu Islet.

Ladd Reef is a small coral patch with 2 to 3 feet water on it lying 2.1 miles 336° from the western extreme of Uanukuhihifu Islet. A similar patch exists ½ mile 123° from Ladd Reef. The northwestern side of the barrier reef within the 20-fathom line northward from Uanukuhihifu Islet to Luangahu Islet is studded with dangerous rocks, many of them very small, and the lead giving but little warning.

Northwest of Ladd Reef the 100-fathom line projects in a horn to the northward, forming a bank over which the soundings are very irregular, with tide rips and overfalls during the strength of the tide, giving the appearance of shoal water, but nothing less than 20 to 23 fathoms was found on this bank.

Anchorage may be found in 18 fathoms, sand and coral, with the western extreme of Uanakuhihifu bearing 212°, distant 1.1 miles, and the north extreme of Tofonga Islet bearing 94°.

In approaching this anchorage from the westward it is necessary to pass 1 mile northward of Uanukuhihifu in order to avoid the dangers which extend nearly that distance northward of the western extreme of that islet.

Luangahu, northward of Ladd Reef, is a small, flat, wooded islet lying 2.9 miles 269° from Tatafa Island, and standing ¾ mile from the western end of a reef 3½ miles long in an east and west direction, which is separated at its eastern end by a narrow channel 200 yards broad from the barrier reef and through which the tidal streams run with considerable strength, causing heavy rips and overfalls.

Thorn Rock is a coral head with 2 fathoms over it, situated 1¼ miles 291° from Luahgahu Islet, nearly ½ mile westward of the western edge of the reef upon which that islet stands.

Hakauata Islet is a small, low, wooded islet, the tops of the trees being 50 feet high, situated 2.8 miles west-northwest fram Luangahu Islet, and standing near the center of a reef nearly 1 mile long east and west. There is a small detached patch with 1½ fathoms on it 600 yards eastward of the edge of the reef.

Bowers Rock is a small coral patch with 3 fathoms over it situated 1¾ miles 339° from Luangahu Islet.

Lua Fakatele is a coral patch about ¼ mile in extent east and west, lying 2.1 miles 229° from Hakauata Islet.

Shoal.—A coral patch, with an estimated depth of from 16 to 18 feet, is situated 1.3 miles southward of Lua Fakatele.

Ava Vahaa Fonua, a good channel between Luangahu and Hakauata Islets, is 1.3 miles wide between Thorn Rock and the eastern extremity of the reef surrounding Hakauata Islet. The objects for fixing being good, there is no difficulty in navigating this passage and avoiding Bowers Rock, which is the only danger there can be said to obstruct it.

Lofanga Island is a flat-topped wooded island 150 feet high, with a bold coast line, situated 1.7 miles west-northwest from Hakauata Islet.

It is nearly 1 mile long east and west by ½ mile in width and is inhabited. The principal village is on its southern side, where the narrow fringing reef which borders its eastern and southern sides affords some protection for boats.

Reef projects to the westward of the island to a distance of 600 yards and there is a small detached coral head, Lua Buki, with 2 fathoms on it at 1,100 yards from the western end of the island. There is also another small coral patch with 2½ fathoms on it, 750 yards northward of the island.

The channel between Lofanga and Hakauata is obstructed by the Lau Maif, a cluster of rocks awash, nearly in the center of the passage.

Lua Faha Lolo is a coral patch with 3 fathoms water and steep-to, situated 1¾ miles 18° from Hakauata Islet.

Hakau Lahi is a reef 2¾ miles long, with an extreme width of 1½ miles encircling a lagoon, lying to the northward of Lofanga Island, from which it is separated by Ava Mata Nukubule. Near the northwest and southeast extremes of this reef, respectively, are two small wooded islets named Miama and Nukubule, the latter being situated 2½ miles northward of Lofanga. Foul ground, in patches, extends in a 173° direction from 1¼ miles from Nukudule.

Balfour Patch is a small coral patch with 5½ fathoms on it, rising from deep water, and situated 3¼ miles 358° from Miama Islet, with the eastern extreme of that islet touching the western extreme of Lofanga Island.

Niniva Islet, flat topped and wooded, 85 feet high, with a sandy beach, is about ½ mile in extent, situated 4¾ miles 314° from Lofanga Island. It stands near the southwestern end of a reef named Hakau Homa ulu, extending in a northeast direction for 3 miles, having an extreme breadth of 1,600 yards and encircling a lagoon.

Haku Homa ulu is separated from Hakau Lahi by Ava Homa ulu, a deep channel over 1 mile in width.

Hakau Iki is a detached coral reef awash, 670 yards in extent, lying 1 mile 296° from Niniva Inlet and separated by a distance of ½ mile from Takau Homa ulu.

Hakau Eihiho is a reef of small extent situated nearly midway between Niniva and Lofanga Islands and obstructing the approaches both to Ava Homa ulu and Ava Mata Nukubule.

Shoal patches extend to a distance of 1,600 yards southward of this reef.

Fotuhaa Island lies nearly 7 miles westward of Hakau Eihiho and 6 miles northward of the Kotu Group. It is steep, wooded, and flat-topped, the tops of the trees being 200 feet high, and is nearly 1 mile long east and west by half that in breadth.

Cliffs from 80 to 90 feet high form the coastline throughout, and landing is only possible in fine weather, either in a small cove on its southern side or by climbing the cliffs at a spot on the northeast side where it is practicable to do so. The island is inhabited. There is no anchorage.

Fatuinanangi is a flat rock of small extent, 10 feet high, situated 2.3 miles 358° from Fotuhaa, from which it is separated by deep water. Shoal water extends to the northward of the rock to a distance of 400 yards.

Eastern reefs.—Uoleva Island is nearly 2½ miles in length northeast and southwest, covered with trees, the tops of which are about 100 feet high and lying about ¾ mile northward of Tatafa Island. It is the southernmost of a chain of islands connected by reef, through which there is no passage, and extending in a north-northeast direction for 14½ miles. Off the northwest coast of the island there are patches of reef with foul ground between them and the shore at a distance of nearly ¾ mile.

Ava Ahanga Mea, the channel separating Tatafa Island on the south from Uoleva Island on the north, is 800 yards wide between the reefs on either side. The tides rush through at the rate of 3 to 4 knots, and on the flood (or eastern stream, which does not begin to make until two or three hours before high water), when the wind is from the eastward, very heavy tide rips and overfalls extend right across the passage, making it highly dangerous for boats. A shoal with from 3 or 4 fathoms over it is situated within the entrance in the center of the channel, and it should therefore only be used by small vessels under favorable conditions of weather and tide.

Lifuka Island—General remarks.—Lifuka Island, separated by a distance of nearly ¾ mile from Uoleva Island, is the principal and southwesternmost of the three largest islands of the group. It is 4.3 miles long and 1½ miles broad at its southern end, tapering to less than ½ mile in width to the northward.

The seaward coast toward the northeast and southeast of the island is bold; the remainder is low and covered with trees, the tops of which are from 90 to 100 feet above the sea, but near the southern end there is an artificial mound 40 feet high and 50 feet in diameter, which, however, is not distinguishable from seaward.

The town (Pangai), situated about the middle of the western coast, is the residence of the governor of the group. There is also a harbor master and a native pilot.

The island is thickly inhabited and cultivated; German and English firms have representatives at Pangai, which is the port of call for the mail steamers.

Inside the 20-fathom line westward of Lifuka, reefs and shoals abound, but iron beacons with cages having been erected on some of the reefs, the approaches to the anchorage of Pangai are easily navigated. The Tongan Government, however, can not be depended upon to maintain these beacons, and in the event of them being washed away, the marks for fixing are by no means good.

The anchorage may be approached either from the northward by Ava Muikuku or from the westward by Ava Tubu. It is much exposed to the bad weather and high winds from the westward, the offlying reefs affording but little shelter from the violent gales from that quarter which occur from November to April, particularly in February and March.

Supplies are not easily obtainable. Fish is but rarely procurable from the natives; eggs and fowls are scarce. There are a few bullocks, one of which is occasionally killed on special arrangements being made. Fresh bread can be had, but fruit and vegetables are scarce. Oua Island, in the southern part of the group, is the only island that produces oranges, and a boatload of these sometimes arrives at Lifuka.

Pineapple, yam, banana, taro, bread fruit, and arrowroot are cultivated; all the islands abound with coconut trees.

Lifuka is not a port of entry.

Tides.—It is high water, full and change, at Lifuka at 7h. 17 m.; springs rise 5 feet, neaps rise 3½ feet.

Two tides of unequal range occur in the 24 hours in the following order, highest high water, lowest low water, lesser high water, higher low water, except during a day or two at neaps when the sequence is apt to become irregular.

When the sun is in north declination, the highest tide of the day occurs between midnight and noon. In south declination it occurs between noon and midnight. Soundings are reduced to a datum 10 feet below a bench mark ⊼ on the sea face of the masonry surrounding the base of the Tongan flagstaff.

Observation spot.—The Tongan flagstaff is in latitude 19° 48′ 17″ S., longitude 174° 21′ 18″ W.

Reefs.—The reefs are so numerous that only a portion of them are described, mostly those bordering the entrance channels; the plan affords much better information than a written description of them.

Hakau Fakaosi Toume is a reef 1,000 yards long east and west, which dries 4 feet at low water; it lies 297° from the northern end of Lifuka Island distant 2.1 miles.

Shoal water extends to a distance of nearly 200 yards eastward of the eastern extreme of this reef; shoal patches also extend ½ mile westward of the reef.

Hakau Muikuku is the shore reef fronting the northwestern end of, and projecting 1,100 yards westward from, Lifuka Island. Its edge is generally indicated by the sea breaking on it.

Mariner Patch is an off-lying coral head with 2½ fathoms on it, situated 200 yards from the edge of the main reef, with the north point of Lifuka Island bearing 74° distant 1¼ miles.

A small red buoy is moored close to the westward of this patch; it is somewhat difficult to pick up until within a short distance of it, and its position can not be relied upon.

Lui Sii is a coral patch with 7 feet water on it, 450 yards 296° from Mariner Patch. It is not always easily seen in passing. Westward of Lua Sii lies Lua Lahi, two rocky patches which sometimes break.

Hakau Mateialona, which dries, lies ½ mile southwestward of Lua Lahi, with sunken rocks extending 200 yards southeastward of it. A patch of 2¾ fathoms lies 600 yards northwestward of the reef.

Hakau Tuaniu is situated southwestward of Mateialona, near the 20-fathom line, and is a reef that partly dries at low water. It is 600 yards in extent north and south, and a coral head with 2¼ fathoms on it lies 200 yards southward of it.

Lua Tula is a coral head, not always easily seen until quite close to it, 700 yards southward of Hakau Tuaniu with Tongan flagstaff bearing 116° distant nearly 2½ miles.

Buchanan Reef, about halfway between Lua Tula and the shore, is a small reef awash.

North and east of this reef there are other reefs and foul ground too numerous to mention, forming part of the inner line of reefs fronting the anchorage off Pangai. This line of reef is prolonged to the southward by Ngahi Hakau Levaleva and Hakan Loa.

Hakau Sela is a small reef that dries at low water, situated 319° distant 1,550 yards from Tongan flagstaff.

Rachel Patch is a coral head with 1¾ fathoms water, 300 yards eastward of Hakau Sela, and lying 1,350 yards 328° from Tongan flagstaff, close to and on the western side of which a small buoy is moored.

Pukefeo is a small reef awash detached from the inner line of reef alluded to above, marked on its eastern edge by an iron staff and ball painted red, and situated 800 yards 32° from Hakau Sela. It may be passed close to on its eastern side.

Hakau Mataleingale is another small reef awash detached from the northeast edge of the inner line of reefs. It has a beacon with iron staff and ball painted red on its eastern edge which may be passed within 100 yards, and is situated 650 yards from Pukefeo.

A rock of 3¼ fathoms is situated at about 260 yards 16° of the beacon on this reef.

Hakau Booi is a small reef awash, with shoal water extending from it to a distance of from 50 to 100 yards on its southeastern and western sides, situated 550 yards 18° from Hakau Mataleingale. It is proposed to place a beacon on the reef.

Fakaamumei Anchorage is off the northwestern edge of Hakau Muikuku in 16 fathoms, sand, with the northern extreme of Lifuka Island bearing 88°, and the buoy on Mariner Patch 178°, distant 600 yards from the edge on the reef.

With westerly winds this is a very undesirable anchorage, but under ordinary circumstances, with the wind from the eastward, it is a convenient place to anchor on arriving after sunset, and too late to enter the inner anchorage.

Channel to the inner anchorage.—Ava Muikuku is the channel from the northward leading to the inner anchorage off Pangai. Depths of not less than 22 feet may be carried through it to the anchorage, and it is the channel usually taken. The objects for fixing being at an inconvenient distance, it is difficult to fix the vessel with sufficient accuracy by bearings, so that the buoys and beacons (if in place) constitute the safest guide. Unless they are in position a vessel other than of light draft can not prudently navigate the channel. On a smooth day at high water it is frequently impossible to distinguish the reefs at all. Vessels of heavier draft than 18 feet are not recommended to attempt to proceed to the inner anchorage.

Directions.—Having ascertained the position of the vessel to the southeastward of Hakau Fakaosi Toume and having made out the Tongan and German flagstaffs at Pangai, steer to bring the buoy on Mariner Patch to bear 190° and pass to the westward of it at the distance of 100 yards, altering course to 219°, the German flagstaff (which is the northern and taller of the two and shows above the tree tops) will be brought right ahead and in line with a somewhat conspicuous tree behind it. This course will lead 1,350 yards clear of the edge of the shallow water off the southwestern edge of Hakau Muikuku and a little more than that distance clear of the shallow water off the western edge of Hakau Booi. The beacon on Hakau Mataleingale will be seen slightly on the starboard bow nearly in line with Tongan flagstaff, and should be passed at 100 yards distance, on passing which a course 178° will pass the same distance eastward of Pukefeo Beason.

When the black buoy marking the western edge of Rachel Patch bears 200°, steer to pass 100 yards westward of it, avoiding a 3-fathom coral head situated 347°, distant 250 yards from Rachel Patch. When about 100 yards past the buoy, altering course to 190° will avoid a 3-fathom coral head lying 150 yards 235° from Rachel Patch, and will lead to the anchorage in 4¾ fathoms, sand, with the German flagstaff bearing 100° and Muikuku Point (northwest point of Lifuka Island) bearing 21°.

Western channel.—**Ava Tubu** is the western channel to the inner anchorage. It is 400 yards wide between the patches off the north end of Ngahi hakau Levaleva and those lying to the south of Ngahi hakau Fatafehi, and carries 27 feet water through it. Approaching from the westward, the channel is between Lua Tula and the patch southward of Hakau Tuaniu, which is ¼ mile wide.

The objects for fixing the vessel are somewhat distant for relying implicitly upon cross bearings, and there being no buoy to mark Lua Tula, caution is necessary in approaching it.

Directions.—Having passed about 200 yards northward of Lua Tula, a 102° course will lead to Buchanan Reef; passing to the south of it at a distance of 100 yards, alter course 119° for the black buoy marking Rachel Patch; this will lead about 100 yards northward of Hakau Sela, which will be seen on passing it. When within 150 yards of the buoy, an alteration of course to 190° will lead to the anchorage. There is little or no current inside the inner line of reefs.

The best approach to the inner anchorage is undoubtedly by Mariner Patch, but the buoy marking this danger is very small, and in a heavy swell is frequently obscured by the crests of rollers even when close to the vessel. Owing to the exposed position and indistinctness of the beacons, buoys, etc., a mariner approaching this part must be prepared to navigate entirely by eye.

Reefs westward of Lifuka.—**Lee Patch** is a small shoal with 9 feet water on it lying outside the outer line of reefs and shoals westward of Lifuka Island, and is situated 280°, distant 3.3 miles from Tongan flagstaff.

Hakau Faha is awash, always breaks, and is 800 yards in length east and west, its western end being situated 29°, distant 3¼ miles from Luangahu Islet.

At 1,800 yards 296° from the western end of Hakau Faha there is a small shoal with 2½ fathoms on it, and another with 3 fathoms on it ¼ mile to the southward of the latter.

Smith Shoal is about 400 yards in extent, with a depth of 2 fathoms. It rises from deep water, and is situated with Nukubule Islest bearing 265°, distant nearly 4½ miles.

Esk Shoals consist of several coral patches with from 1¾ to 3 fathoms over them situated on a bank 1.1 miles in length by ¼ mile in width within the 10-fathom limit. The bank rises from deep water all around, and lies 3½ miles 32° from Smith Shoal.

Luahoko, northeastward of the Esk Shoals, is a small low islet, covered with trees 45 feet high, surrounded by a reef which extends ¼ mile from the islet on the north side, lying 254°, distant 5¾ miles from the north point of Haano Island.

Shoal water extends to a distance of ¼ mile southward of the islet.

Ofolanga, the northernmost in the neighborhood, is a low islet covered with trees and coconuts, the tops of which are 80 to 90 feet high. It is ¾ mile long north and south, by half that in breadth, with a sandy coastline and is uninhabited. It lies 9.1 miles 288° from the north point of Haano Island.

Natives from Moungaone Island frequently visit it for fishing purposes and have erected huts. It is surrounded by a barrier reef encircling a lagoon. In a 336° direction this barrier reef extends 1¼ miles from the island, and about ¾ mile eastward and westward from it. The edge of the barrier reef is steep and free from offlying dangers, except off the southeast corner, where a shoal patch with 4 fathoms on it lies 250 yards from the reef.

Buhi is a rock, 20 feet high, near the western edge of the reef surrounding Ofolanga.

Anchorage.—Southward of Ofolanga the barrier reef forms a slight indentation where anchorage in 13 fathoms, sand, may be obtained at 350 yards from the reef, with the southwest extreme of the island bearing 1° and the southeast extreme 69°.

This anchorage is protected from northerly and easterly winds.

Landing.—There is a break in the reef near the southeast corner of the island through which boats can pass, except at low water.

When there is much swell, however, landing is frequently impracticable.

Observation spot, the southeast corner of the island, is in latitude 19° 36′ 17″ S. longitude 174° 27′ 23″ W.

Moungaone Island lies 2.1 miles 223° from Ofolanga Island, with a deep channel between. It is 1 mile long by ½ mile wide, with a rocky and bold coast line with no fringing reef, except on its southeastern side, where there is a sandy beach fringed by a reef extending about 200 yards from the shore. The island is flat-topped and wooded, the tops of the trees being 100 feet high, and there is a village on its southeastern coast. Landing can only be effected in fine weather. There is no anchorage, and the 100-fathom line skirts the shore at about ½ mile distant.

Eastern Islands.—**Foa** is the next island northward of Lifuka, standing on the same reef, and separated from it by a gap 800 yards in width. It is 4 miles long in a northeast and southwest direction with an extreme breadth of 1.3 miles. is low and covered with trees, the tops of which are about 100 feet high. A low cliff forms its eastern coastline, while its western side is a sandy beach with rocky points. The shore reef on that is much broken up, and there are several off-lying patches near the shore. There are several villages on the island, which is thickly planted with coconut trees.

Nukunamu is a low wooded islet ½ mile long north and south, lying close to the northward of Foa Island.

Haano Island, the northernmost of the three principal islands of the group, lies ¾ mile northward of Nukunamu Islet, and is 3½ miles in length northwest and southeast, by from ¼ to ½ mile in breadth, and is inhabited. A barrier reef upon which the sea breaks heavily follows the trend of the eastern coastline of the chain of islands from Uoleva Island northward, separated from the shore by a narrow channel. Northward of the north end of Haano the barrier reef projects over ½ mile. On the western side it becomes a fringing reef with a broken and irregular edge, for the greater part of its length, and the 20-fathom line northward from Lifuka to Haano Island extends from 200 to 600 yards from the edge of the fringing reef, affording sufficient room for anchoring at a few places along the coast under the lee, when the ordinary trade wind is blowing, but would be unsafe with a westerly wind.

Directions.—On approaching the group from the northwestward the three islands, Haano, Foa, and Lifuka, appear as one low line of land broken by gaps; if making for Lifuka anchorage steer for the second gap from the northward.

Lua Lafalafa is a coral bank about ½ mile in extent. with from 4 to 5 fathoms over it, rising from deep water, lying to the westward of Haano Island, with its center situated 2½ miles 226° from the northern point of that island.

Crawshaw Shoals, with 2½ to 3 fathoms over them, are situated on a coral bank rising from deep water 2½ miles southward of Lua Lafalafa. The bank betwen the 10-fathom limit is over ½ mile long in a 246° and opposite direction, by ¼ mile in breadth, and the southwestern end is situated 347°, distant 2½ miles from the southwestern extreme of Foa Island.

Bethune Bank.—North-northeastward of Haano Island there is a coral bank extending in a northerly direction for about 7 miles, within the 100-fathom line. On the southeastern part lies Bethune Bank about 1 mile in extent within 10 fathoms limits, with a depth of from 7 to 10 fathoms, its center lying about 5 miles 44° from the northern extreme of Haano Island. At 2 miles northwestward of Bethune Bank there is a bank with 16 fathoms least water.

On the northern part of the main bank there are depths of 12 to 16 fathoms, and 2½ miles westward there is another small bank with 18 fathoms over it with deep water around.

Falcon Bank.—Between Haano Island and the Vavau Group there are a succession of banks separated by deep water. Falcon Bank lies 22 miles 27° from Haano Island, and is 4 miles in length east and west by about the same in width. Soundings of 7 to 9 fathoms were obtained upon it, but it was not exhaustively examined, and there was every appearance of shoaler water upon it.

Disney Reef, with a depth of 2½ fathoms, which breaks when there is any swell, lies about 2 miles northeastward of Falcon Bank. Both are steep-to.

Hakaufussi is a sand cay 5 feet high, situated about 17 miles northward of Disney Reef. It is encircled by reef and foul ground that usually breaks to a distance of over ½ mile on its northern and eastern sides. Landing can only be effected in very fine weather.

Campion Breakers.—At 3 miles 221° from Hakaufussi there is a shoal 1 mile in extent upon which the sea breaks even in fine weather, and shoal water extends 2 miles westward of the breakers. At 4 miles southward of Hakaufussi there is a shoal over 1 mile in extent with from 7 to 9 fathoms over it.

Banks and islets, as charted, lie between Hakaufussi and the east extreme of Vavua, near the edge of the 100-fathom line.

Akkumanes Bank extends in a southerly direction for 14 miles from Hakaufussi, and its western dege within the 100-fathom limits is very irregular in shape. It is separated from the bank upon which Disney Reef stands by a deep channel 1½ miles wide. The general depths on the bank range from 25 to 35 fathoms, but along its southeastern edge there are depths of 12 to 14 fathoms. On the east-going (or flood) stream there are tide rips and overfalls on the shoaler parts of the bank.

Tidal streams.—Between Haapai and Vavau the general result of a large number of observations made while the ship was at anchor on different parts of the banks during the survey tends to show that at springs the easterly stream begins to make about 1½ hours before high water by the shore and runs till about 4 hours after high water. The direction varies from east-southeast to north-northeast, attaining its maximum strength of from 1¼ to 1¾ knots at northeast, gradually changing its direction to the northward. The westerly stream begins to make from 4 to 5 hours after high water, its direction ranging from northwest to southwest, with a strength of from 1½ to 2 knots.

The tidal streams are, however, liable to considerable variation, both in force and direction, and also in the time for turning, and the foregoing can only be taken as a general guide. Sometimes the easterly stream does not begin to make until nearly high water, but it seldom runs for a longer period than 4 hours after high water.

Toward neaps the easterly stream is frequently very faint and iregular in its time of turning, and the westerly streams then predominate throughout the day. Occasionally, however, the easterly stream has been found to run for as long as 48 hours without intermission. Little dependence can, therefore, be placed on tidal streams in any part of the group.

Tofua Island, situated westward of Haapai Group and separated from it by a deep channel 15 miles wide, is an active volcano and appears flat-topped from the sea. It is 5¼ miles long in a north and south direction by 3¾ miles broad, with steep, bold coast line almost throughout. The hills, from 1,500 to 1,645 feet in height, rise steeply from the coast except on the northwest side, where the slope is more gradual, forming the walls of a large crater which occupies the center of the island, at the bottom of which there is a remarkable fresh-water lake. Smoke was seen in 1898 to be issuing from a vent at the northwest end of the lake.

On the south and southwest sides the hills are wooded to the summit, but the northern and northeastern slopes are barren and wooded only in the ravines. Coconut trees were seen to be growing on the lower slopes. There is a village somewhere on the northeast side high up on the hill, but it is hidden by trees from seaward. The island is steep-to around, and there is no anchorage. Landing may be affected in fine weather on the north side.

Kao Island lies to the north of Tofua, separated from it by a deep and clear channel nearly 2 miles in width. It is 2¾ miles long north and south by 1¾ miles wide, and rises in the center to a magnificent peak 3,380 feet high, which appears as an almost perfect cone from every direction.

Its lower slopes are wooded, the upper part barren except in the ravines which score the mountain side deeply in places. There is an extinct crater on the northern side near the summit and another on the southern side in which fresh water lodges. This is the only water to be found on the island, which is uninhabited.

Landing can be effected only in very fine weather, the most promising spot appears to be on the northwest coast. The coast line is rocky and bold in many places, and is steep-to all around, with no anchorage off it.

At 1¼ miles northward of the island there is a rock 3 feet high with depths of 14 to 15 fathoms ¼ mile northwestward of it; the 100-fathom line passes 1 mile northward of the rock.

Metis Shoal.—In 1886 this was reported as an island 150 feet in height. It was in 1898 a small shoal with about 2 fathoms water over it, and upon which the sea breaks occasionally, situated between Kao and Late Islands with the latter bearing 26°, distant 25¼ miles.

There are shoal patches which were not examined, but with probably 4 or 5 fathoms over them (and perhaps less) lying about 1½ miles northward and northwestward from the spot that breaks. These shoals rise abruptly from deep water.

Home Reef is small and lies nearly midway between Metis Shoal and Late Island, having a depth of about 1 or 2 fathoms over it, upon which the sea frequently breaks. It is situated with Late Island bearing 32°, distant 13 miles.

Late Island, situated about 28 miles westward of the Vavau Group is high and volcanic. The peak, 1,700 feet high, is near the center of the island from which the hillsides slope gradually to the sea. This island is about 9 miles in circumference and visible at a distance of 50 miles in very clear weather.

From the south side round by east to the northwestward it is bare and rugged with deep fissures about one-third down from the crater; below the fissures a quantity of scrub grows. The remaining portion is well wooded, showing a few patches of coconut trees and large quantities of iron wood.

The landing place is on the north side in a small indentation of the coast, but it is not good; the boat has to lie alongside the rock and the opportunity seized to jump on shore. Wild pigs and pigeons abound in the bush, and from the hollow stems of the coconut trees a small quantity of rain water is obtainable. There are no inhabitants, but natives of Vavau occasionally visit the island to collect coconuts and bananas, which are cultivated.

On the east coast there is a second crater, now inactive, which has been reported to be oval in shape, the inner sides rising perpendicularly from a small flat ledge, surrounding a lake, whose depth and quality there was no means of ascertaining. The large crater is immediately below the peak, and a small jet of vaporous-looking smoke was seen issuing from its sides.

There is a shelf running off the north side of the island, upon which anchorage in 15 fathoms, sand and stone, may be obtained at 670 yards from the coast, with the peak bearing 173°.

There are no offlying dangers, and the coast, which is bold, appears to be steep-to within a very short distance.

The swell and tide rips meeting opposite squalls of wind from off the island gives strong resemblance to breakers.

Except on the northern side, where it projects further, the 100-fathom line encircles the island at the distance of about ½ mile.

Vavau Group consists of the large island Vavau and numerous smaller islands extending north-northeast and opposite direction for 18 miles and 19 miles broad. The north side is high and steep-to, but to the southward there are many outlying reefs and small low islets. The water is very deep throughout the group and anchorages are few and indifferent.

Vavau Island is the principal island of the group. It is nearly 9½ miles in length east and west, with an extreme breadth from north to south of 6¾ miles, and is very irregular in shape on its southern side.

The northwest, north, and northeast coasts are bounded by cliffs from 600 to 200 feet high, the face of which is generally covered with vegetation, with landslips here and there showing in large white patches, and there is no fringing reef except around the small indentations on the northeast coast.

The island is of upraised coral formation, presenting a remarkable appearance from the westward, the northwestern side being cultivated up to a height of 670 feet and slopes to the southeastward. There is a conspicuous flat-topped hill, named Moungalafa, 610 feet high, at the southwest end of the island, the top of which falls steeply on all sides showing as a prominent feature, and Talau is another conspicuous hill, visible from the southward, 430 feet high, and occupying the western end of a promontory westward of Neiafu anchorage.

To the northeast of Moungalafa lies Ano Lagoon, shallow at its eastern end, but very deep at the western end. Ducks are plentiful. Numerous villages are scattered over the island, connected by turf roads, and a road runs around the northern coast along the edge of the cliffs for the greater part of the way.

The population of the whole group is estimated at 3,500, of whom the greater number are resident on Vavau, and the remainder are distributed amongst the other larger islands.

Labor is difficult to obtain; the natives will not work under $1 a day. The traders import labor from other islands of the Pacific.

The island is covered with thick bush and coconut trees, with numerous patches of land under cultivation; also orange and lemon trees.

Aspect.—When approaching the group from the southward Fatu Manga Islet will be seen in the foreground, and beyond it Hunga, Kalau, and Fofoa appearing as one island, terminating to the westward in a bluff headland, with a second bluff showing a short distance to the right of it. Further to the right the high land of Vavau will be distinguished, also terminating to the westward in a high bluff, and in front the well-defined, table-topped hill Moungalafa shows higher than the more distant flat-topped land behind. Further to the eastward the land becomes fainter and lower as it recedes in the distance. Talau Hill, near Neiafu anchorage, is readily distinguishable, showing prominently against and higher than the fainter land behind, in front of which Kapa Island will be seen, showing flat and featureless, except for a slight conical elevation, Mount Teisina, near the right-hand part of it.

Fata Point is the southwestern extremity of Vavau, immediately underneath Moungalafa Hill. A ledge of rock extends westward from the point for 350 yards and therefore it can not be rounded closely.

Port Refuge is a slight indentation on the western coast of Vavau about 1 mile northward of Fata. It is fully exposed to the westward, and the water is too deep to afford convenient anchorage. At 300 yards from the point on the northern side of Port Refuge is Fotula Rock, 85 feet high.

Muitoulo is the bold headland forming the western end of Vavau, 645 feet high, and steep-to. There is a conspicuous white patch on the cliff to the southward of it, and the highest part of the island lies a short distance to the eastward.

Houmafakalele, the northwest extreme of Vavau, projects in a high, narrow promontory 370 feet high, falling in a steep cliff from the higher land immediately behind it. It lies 49°, distant 4¾ miles from Muitoulo, the high, bold coast between forming Vaiutukakau Bay, 1 mile deep. In this bay anchorage in 20 fathoms may be obtained at ¼ mile from the shore, but when blowing fresh, violent gusts sweep down from the highland above from different directions.

Matakiniua.—From Houmafakalele a bold coast trends east-northeastward for 1¾ miles to Matakiniua, a grassy knoll 550 feet high near the edge of the cliff, from which a fine all-around view is obtained, and from thence it trends eastward with a few minor indentations for about 2¼ miles to Matautuliki, the north point of the island, under which there is a remarkable conical white patch on the cliff just above the sea.

Coast.—From Matautuliki the cliffs generally decrease in height and the coast takes an easterly direction for 4½ miles to Nukumalolo, the southeastern point of the island, forming two small bays, the heads of which are fringed with reef. The 20-fathom line skirts them a sufficient distance to give room for anchoring, but, being exposed to the eastward, and the bottom rocky, they are useless for anchorage purposes, and they were not closely examined.

From Nukumalolo the coast, with several deep bights, and fronted by numerous small islets, takes a southwesterly direction for 5 miles to Ahanga Passage, an opening about 50 yards broad separating Vavau from Pangai Motu, across which reef extends and can only be used by boats near high water. This opening is at the head of an arm of the sea, on the eastern side of which stands the town of Neiafu.

Neiafu, situated on the southwest coast of Vavau, 1 mile eastward of Talau Hill, is the port of call in the Vavau group for the mail steamers, which call here from Sydney every four weeks. The governor of the group resides here, and it is the headquarters of some English and German trading firms. The Government offices are close to the landing place.

Position.—The observation spot at the Tongan flagstaff is in latitude 18° 39′ 0″ S., longitude 173° 59′ 14″ W.

Wharf.—There is a good wharf which vessels of 18 feet draft can go alongside, but it is necessary to drop an anchor by which to haul off and a kedge from the quarter to keep the stern from tailing too far in, as the wharf hardly projects sufficiently for a long vessel without that precaution, the bottom being very uneven westward of the wharf, with several lumps of coral sticking up through the sand. In going alongside and hauling off it is necessary to bear in mind the existence of a rock with 2 fathoms water on it at 25 yards southeast from the end of the wharf.

A red light is shown at night from the southwest corner of the wharf.

Supplies.—The country affords plenty of vegetables and fruit. Oranges and lemons are in great abundance; pineapples, yams, bananas, sweet potatoes, and taro are all under cultivation; coconuts are grown on the islands. Water in wells is scarce and indifferent; water has to be collected and stored in tanks.

Coal.—No coal is to be obtained.

Exports.—The principal items of exports are copra, oranges, pines, and bananas.

Neiafu Harbor, between the northeast coast of Pangai Motu and the southwest coast of Vavau, is landlocked, but the holding ground is indifferent and the general depth of water, 25 to 29 fathoms, is too great for convenience. From the town of Neiafu the coast trends westward for nearly ½ mile to Kilikili Point, which is steep-to within 50 or 60 yards and upon which there are two leading beacons, 18 feet high and painted white.

Westward of Kilikili the coast forms a bight to the northward, fringed with reef, and then taking a southwesterly direction forms the promontory on which Talau Hill stands. Immediately to the westward of the above-mentioned bight there are two white beacons 18 feet high, 290° and 110° from each other, for leading to the anchorage. At ¼ mile southeastward of the wharf at Neiafu there is a conspicuous Roman Catholic church (with spire and cross on top on its southeastern end), built on rising ground just above the coast, with a white beacon immediately underneath it on the shore, which beacon is in the same line as the Talau beacons.

Harbor limits.—Two small white beacons (staff and diamond), one on the southern extreme of Talau Promontory and the other on the northwest coast of Pangai Motu, 1,350 yards southwestward of Muitafuna Point, mark the limits of the harbor.

Tides.—It is high water, full and change, at 7h. 5m.; springs rise 5 feet, neaps rise 3¼ feet.

Two tides of unequal range occur in the 24 hours in the following order: Highest high water, lowest low water, lesser high water, higher low water, except during two days at neaps, when the sequence is irregular.

When the sun is in north declination the highest tide of the day occurs between midnight and noon, and in south declination the highest tide occurs between noon and midnight. The soundings are reduced to a datum 11 feet 6 inches below the top of the flooring of the wharf.

Muitafuna Point is a sandy point at the north extreme of Pangai Motu Island, which must be rounded to approach Neiafu anchorage. A shoal spit with three fathoms at its extremity projects in a 61° direction from the point, to a distance of over 200 yards from the shore, leaving a channel 100 yards wide between it and Kilikili Point. Westward of Muitafuna Point shoal water also extends over 200 yards from the shore.

Light.—From a concrete pile beacon erected in a depth of 19 feet on the extremity of the spit extending northward from this point, is exhibited a fixed green beacon light, elevated 5 feet, and visible from a distance of about 5 miles.

Vessels of heavy draft should not closely approach this beacon.

Galloway Rock, with 3 fathoms water over it, is a small coral head situated 370 yards 294° from Muitafuna Point and 150 yards from the Talau shore. A rocky ledge with 6 to 8 fathoms over it here stretches right across the channel, and the beacons on Kilikili Point must be kept in line while crossing it, which leads 75 yards southeastward of Galloway Rock.

Buoy.—A white conical buoy is established in a position 50 yards southward of the eastern head of this rock.

Shoal.—A shoal of 5 fathoms is situated about 130 yards southward of the eastern head of Galloway Rock, on the line of Kilikili leading beacons.

Talua Hill.—The promontory 1 mile westward of Neiafu rises to a conspicuous flat-topped wooded summit, 430 feet high, falling steeply on all sides, with a slight depression in the center, and a single tree higher than those surrounding it, near its eastern end. The coast line of the promontory is bold with no fringing reef, but shoal water extends to a distance of 100 yards to the southward.

Northward of Talua, a narrow arm of the sea extends 2½ miles inland, along the western shore of which trends a ridge of hills; one of them, Kafoa, 420 feet high, is conspicuous by being crowned by a large clump of casuarina trees.

Teleki Point.—From Fata, the southwestern point of Vavau Island, a rocky coast with low cliffs trends 89° for 1 mile and thence northeast for 1.3 miles to Teleki Point, forming the northern side of the channel leading to Neiafu Harbor. A narrow fringe of reef borders the point, which is steep-to within a short distance.

Jetty.—**Tuanuku** is a village nearly 1 mile southwestward from Teleki Point. The trading companies have erected storehouses and other buildings, which are conspicuous on the rising ground a short distance from the coast, and have built a stone jetty alongside which small craft can lie. A mooring buoy is laid down in 20 fathoms water at 350 yards 83° from the jetty for the convenience of their trading vessels. Ano, a shallow, brackish lagoon upward of 1 mile in length, where duck may be shot, extends behind the village in a northwesterly direction.

Lotuma is a small wooded islet, 90 feet high, lying 250 yards off the northwest coast of Pangai Motu, and situated ½ mile 122° from Teleki Point. A narrow fringe of reef and shoal water extends from 50 to 100 yards from the islet on its northern and western sides.

Otungaki is an island about 1¼ miles long north and south, narrow and wooded, rising near its southern end to a summit 290 feet high. It lies immediately westward of Pangai Motu and connected with it by a reef. Its northern point, Hikutamole, lies over ½ mile southward of Teleki Point, and is a sandy beach off which rocks and foul ground extend about 100 yards. The northwestern and northern coasts form the southern side of the channel leading to Neiafu anchorage. Reef projects from its western extreme to a distance of about 200 yards.

Directions for approaching Neiafu Harbor.—Passing Fata, the southwestern point of Vavau, and keeping in mid-channel, when Talau opens out, steer for it on a 55° bearing, passing 300 yards northward of Lotuma Islet; the white leading beacons on Kilikili Point will be seen in line bearing 66°. This leading mark leads in mid-channel over the rocky bar between Talau and Pangai Motu, and nearly 100 yards southeastward of Galloway Rock. Easing speed in sufficient time on account of the sharp turn, when Muitafuna Point is abeam, the course may gradually be altered to the eastward to round the shoal spit projecting to the northeastward from that point, bringing the two beacons under Talau Hill in line astern, bearing 290°, which mark clears the shoal spit and leads up to the anchorage off Neiafu in 18 fathoms, sand and coral, with the Roman Catholic Church bearing 100° and the western end of the wharf bearing 21°.

Kapa Island is inhabited and is 3 miles in length northwest and southeast, lying over ½ mile southward from Otungaki. Its northern portion forms a narrow peninsula, the northwest end of which is situated ¾ mile southeast from Fata Point. The southern part of the island is 1 mile in breadth, high, and densely wooded.

Its most prominent feature is Mount Teisina, near its southern end, which shows as a good summit from most directions; it is 315 feet high, partially cleared, and is crowned by a large casuarina tree. Westward of that summit the land is rather higher and flat topped, falling to the westward in a steep shoulder just above the coast.

To the northward the land falls to 220 feet in height. The coast line is bold throughout, broken by a few sandy beaches, and the southwest coast is fronted by detached patches of reef extending ¼ mile from the shore.

On its western side the coast forms Port Maurelle, but it is too confined and the water too deep to be recommended as an anchorage. There is a large cave near the northwest end of the island, into which a boat can enter.

Mala is a small wooded islet lying southward of Otungaki and midway between that island, and the northeast cost of Kapa. Rocks and foul ground extend right across between the islands, but there is a boat passage southward of Mala.

Anchorage between Otungaki and the northern portion of Kapa may be obtained in 29 fathoms, sand and coral bottom, with the southwestern extreme of Mala in line with the southwestern extreme of Lautala bearing 141°, and the western extreme of Otungaki bearing 16°. The water shoals very suddenly along the edge of the foul ground above mentioned, so there is nothing to be gained by anchoring near its edge in the hope of getting better anchorage water.

This anchorage is specially convenient on making the group too late in the day to proceed through the narrow channel to Neiafu Harbor before dark. The bottom is rocky, and it is said that several anchors have been lost there at various times, but the same is probably true of any part of the group. In bad weather from the southeastward it is protected from all sea or swell, and the wind is steady in direction, being uninfluenced by the land.

Nua Papu, lying 1½ miles westward of Kapa Island, extends from its northern extreme in a southwesterly direction for 2 miles, and in a south by east direction for 1¾ miles; and is nowhere much more than ¼ mile in width. It is flat-topped and wooded, from 210 feet to 80 feet in height, and is inhabited. The coastline is mostly bold and steep-to, except on the southern side, where there are some sandy beaches fronted by reef. A narrow flat-topped wooded islet, Kitu, 200 feet high, with precipitous sides, extends from 100 yards to 700 yards northward from the north extreme of the island. Between Nua Papu and Kapa there are two high flat-topped islands also with precipitous sides and steep-to.

Vakaeitu lies 600 yards southward of the southwest extreme of Nua Papu, and is connected with it by a reef. The western coast line, which is bold, extends in a southerly direction for ¾ mile, and then the coast turns abruptly to the eastward for about the same distance. The island is narrow, 155 feet high and wooded, with a village near a sandy bank on the northeast coast. At 400 yards eastward of the island, and connected with it by a reef, there is another small island 130 feet high.

Ovaka Island, 1½ miles long in an east-northeast and opposite direction, lying to the southward of Vakaeitu, and with a deep channel between them, is steep-to and bold at its western end, wooded, flat-topped, and 190 feet high. A reef extends for 2¾ miles to the eastward with some rocks and islets upon it.

Anchorage.—Between Vakaeitu and Ovaka Islands the water is deep, but anchorage in 29 fathoms, sand and coral bottom, may be obtained with the eastern extremity of Ovaka bearing 156°, and the western extremity 249° opposite a slight indentation in the coast in which there is a village.

Muomua is a small wooded island, 135 feet high, with bold coast line, and steep-to, lying 1,350 yards south-southwest from the southwestern end of Ovaka Island.

Fangasito is a small rocky islet, 60 feet high, lying 670 yards 173° from Muomua, and is steep-to.

Hunga, Kalau, and Fofoa, separated by openings only 50 to 100 yards wide, thus forming practically one island, are situated to the northwestward of Nua papu and Vakaeitu Islands, and taken together extend 3¾ miles in a southwesterly direction from the northeast point of Hunga Island. Hunga is much the largest of the three, the other two merely forming the continuation of the southwest coast of that island.

Fofoa terminates at its southwestern extremity in a prominent wooded bluff 205 feet high, and at ½ mile to the northward of it Kalau also terminates at its southern end in a high bluff. Eastward of the two latter islands, and between them and an arm of Hunga Island, which projects to the southward, a sheet of water is nearly encircled by them with depths of over 20 fathoms in it, but the narrow openings between the islands are barred by reef.

The villages on Hunga Island stand near the eastern and northeastern shores of this sheet of water.

The northwestern coast of Hunga is convex in shape and rocky, falling in steep cliffs and bold headlands, from 220 to 245 feet high. The 20-fathom line projects over ¼ mile from the shore in places. The extreme breadth of the islands is ¾ mile near the center, tapering toward the northeastern extreme, which is bold and steep-to.

The eastern coast is concave, forming a deep bight, in the center of which at 670 yards from the shore is situated Luamoko Island, 230 feet high, small, wooded, flat-topped, having precipitous sides with a narrow fringe of reef on its eastern side, and steep-to.

Luafatu and Tuungasika are two small, flat-topped, high islands situated 80°, distant ½ mile, and 61°, distant 1 mile, respectively, from the northeast extreme of Hunga. They fall precipitously on all sides, and are steep-to.

The west point of this island is a bare cliff which, when seen from the southwestward, resembles a sail.

Faih Ava, between Hunga and Vavau, is a deep and clear channel from the northwestward, on which are Luafatu and Tuungasiki Islands, which may be passed close-to. A white patch on the cliff on the western coast of Vavau is very noticeable in this channel, and also another smaller patch on the northwest of Hunga Island. It is the approach from the northwestward to Neiafu Harbor.

Foelifuka is the southwesternmost of the islands off the southwest end of Hunga Island. It is nearly ½ mile in extent, wooded, and 125 feet high, and connected with Fofoa Island by a narrow strip of reef, on the western side of which is a small low rocky islet. Close to the eastward of Foelifuka is another small wooded islet, 125 feet high. Between Foelifuka and Hunga Island the space is occupied by detached patches of reef and foul ground.

Tefito Maka is a rock about 4 feet above high water, lying 1,400 yards 212° from Foelifuka, and standing on the bank which extends to the southward from that islet for 1½ miles within the 20-fathom limit. Near the southern edge of this bank there is a small patch with 9 fathoms over it. Between Tefito Maka and Foelifuka the soundings are irregular and vessels should not pass between them.

Fotuaika Mamaha is a small coral patch, with a depth of 5 fathoms over it, siutated 2 miles 185° from Tefito Maka. It stands on the northeastern edge of a bank ½ mile in extent within the 20-fathom limits, and on the southwestern side of the bank there is another shoal patch with 6 fathoms over it. With a heavy swell from the southward these patches occasionally break.

Fotuaika Moana is a small coral patch, with 7 fathoms over it, situated about 1,400 yards 212° from Fotuaika Mamaha, and upon which the sea also breaks in bad weather.

Fatumanga, the southwesternmost island of the group, is small, flat topped, precipitous, and barren, and is 85 feet high. It is situated 201° distant 4.6 miles from Foelifuka. A shoal extends ½ mile southward of the islet, upon which there is a rock that breaks. Approaching the group from the southward Fatumanga should be steered for, and it may be passed on either side, giving a berth to the shoal mentioned.

Fonua-one-one is an islet ½ mile in extent, low, flat topped, and wooded, the tops of the trees being 75 feet high, lying 3¼ miles 94° of Fatumanga. It is bordered by a narrow fringing reef, the edges of which are steep-to.

Lua Atofuaa is a coral patch of small extent with 2 fathoms over it, which nearly always shows by breaking, and lies ¾ mile westward from Fonua-one-one.

Ava Pulepulekai is the channel between Hunga Island and Nuapapu. It is over 1 mile wide, is deep and clear of dangers, and the shore on both sides of the channel is bold and steep-to.

Bound to Neiafu Harbor from the southward and westward it is the channel to be used.

The approaches to it from the southwestward are partially obstructed only by Tefito Maka and Fotuaika Moana and Fotuaika Mamaha.

The north shoulder of Moungalafa Hill in line with northwestern extreme of Nuapapu 45° leads 800 yards from Fotuaika Mamaha and 1,600 yards from Tefito Maka.

Euakafa (lat. 18° 45′ S., long. 174° 02′ W.) is the highest and most conspicuous amongst the smaller islands in the southern part of the group. It lies 1¾ miles to the southward of Kapa and 3 miles eastward from Ovaka. Its summit is flat topped and wooded, 270 feet in height. A fringing reef projects for 600 yards southward of the island, with a deep passage 900 yards broad eastward of it between Euakafa and Euaiki Islands. Westward of Euakafa there is no passage for a vessel through the reef and foul ground extending between that island and Ovaka.

Fuamotu is another flat-topped wooded island. 185 feet high, surrounded by reef lying nearly 2¼ miles 145° from Euakafa.

Lua a Fuleheu and Lua Hiapu are two small, low, wooded islets lying east and west from each other, distant 1,700 yards, each encircled by reef. The western of the two, Lua a fuleheu, lies 2.1 miles 134° from Fonau-one-one. There are two shoal patches with 3 fathoms and 1½ fathoms water on them, situated, respectively, 291° and 234° from Ta ula, distant about 1 mile.

Finau Patches, with 5 fathoms water over them, are two coral shoals ½ mile apart northwest and southeast from each other, the western of them lying over 1½ miles 206° from Fonua-one-one.

Richards Patches, with from 5 to 6 fathoms water over them, are coral shoals extending 2½ miles west-northwest and east-southeast, the western end of which lies 2½ miles 226° from Lua a fuleheu.

Maninita is the southeasternmost islet of the group, low and wooded, and lies 5¼ miles from Lua a fuleheu Islet. A similar islet Ta ula lies nearly 1 mile 317° from it. The southern end of the reef and foul ground at the southeastern end of the group lies 217°, distant 3¼ miles from Maninita Islet.

Lalalolomei Bank, with 7 to 9 fathoms over it, and about 1 mile in extent, lies 6 miles 212° from Maninita Islet and 5 miles 336° from Hakaufussi sand cay.

Koloa, Faioa, Umuna, and **Kenutu** are a chain of islands extending along the eastern side of the group in a southerly direction for 4 miles from the southeastern extremity of Vavau Island. They are connected by reef, and their eastern coast is bold and steep-to. At 1½ miles westward of this chain of islands there is a second chain parallel to them. Between Kenutu and Maninita Islet, a distance of nearly 10 miles, the eastern side of the group is bounded by a succession of reefs upon which there are at intervals three small, low, wooded islets. Shallow water, upon which the sea breaks heavily if there is any swell, and over which there are at all times blind rollers, exists between the patches of reef along the whole of this distance, and there is no channel fit for a vessel to navigate.

A large portion of the group eastward and northeastward of Euakafa and Fuamotu Islands is absolutely unapproachable, the whole of the area being surrounded by reefs with no navigable channel.

The 100-fathom line follows the line of these reefs and shoal water at a short distance to the eastward.

Winds and weather.—Vavau is the wettest part of the Tongan Group. In the month of June, 1898, nearly 20 inches of rain fell there.

From May to November the strongest winds generally experienced from south by east to southeast by east, usually accompanied by rain from these quarters and lasting three days. On the wind shifting to the northward of east, fine and settled weather may be expected for a time.

After September strong northwesterly winds with thick, dirty weather and heavy rain may occasionally be expected, but the wind does not appear to remain longer than 12 hours in that quarter, and will then probably shift to the southward and clear up.

Islands north of Vavau.—Toku Island is a small, flat-topped, wooded island, the tops of the trees of which are 85 feet above high water, lying 27 miles 345° from the north end of Vavau.

The island is encircled by a fringing reef which projects from it to a distance of nearly ¼ mile in a northerly direction. Depths of 69 to 76 fathoms were found within 1 mile to the northeastward of the island, and between these soundings and the reef there appeared to be shoaler water. A rock awash upon which the sea breaks heavily exists 1¼ miles 265° from the southwest end of the island with apparently deep water between.

Fanua Lai (lat. 18° 01′ S., long. 174° 19′ W.), named by Maurelle Amargura (Spanish for bitterness), because he was disappointed in not finding provisions there. The island is 1¼ miles long in a north and south direction by about 1 mile in breadth, rising to a sharp and well-defined summit 600 feet high, which falls abruptly to the sea on its southern side in light gray-colored cliffs, and lies 12 miles 325° of Toku. The coast is bold, except on the northwestern side, where there is a small bight with a sand and shingle beach upon which landing is possible in fine weather.

To the northward of the peak, which is the summit of a small ridge running east and west, covered with vegetation, the land falls. It rises again on the western side of the island to a broad, barren, lava-streamed ridge, 500 feet high, and on the eastern side a lower ridge, from which a faint column of smoke was observed to rise, follows the coast, terminating in a summit near the north end of the island, 370 feet high.

The hills form the walls of a crater, a small portion of which has been blown out on the northwest side, thus giving access to the crater from the beach on that side. The valley so formed in the interior is cultivated, but no inhabitants are permitted by the Tongan Government to reside there on account of its liability to eruption. The island is visited by natives from Vavau from time to time to collect its produce.

There is a narrow fringing reef on its northeast, south, and west sides. In November, 1898, there was a remarkable appearance of discolored water for some considerable distance to the northward and northeastward of the island, bearing a strong resemblance to an extensive shoal; soundings, however, were obtained in from 200 to 300 fathoms. A native living at Vavau, to whom the island belongs, reports that there are no offlying dangers outside the fringing reef. Deep soundings of over 100 fathoms were obtained all around within 1 mile of the coast, but the native alluded to above states that there is a shelf of anchorage water in about 20 fathoms off the beach on the northwest side, which extends ¼ mile or so from the shore.

Search was made in 1898 for the dangerous reef reported to exist about 4 miles westward of Fanua Lai. The soundings were carried to a distance of about 10 miles in that direction, but no sign of any danger could be discovered, nor was the water in any way discolored. The current was at that time setting to the northward, and the discoloration of the water, northward and eastward of the island, which was so strongly marked, may have been done by the minute particles of volcanic matter held in suspension and washed from the coast.

A westerly current would produce the same appearance to the westward, and it is not improbable that the report of a dangerous reef there may have had its origin in that manner. This reef has been expunged from the charts.

In August, 1847, Fanua Lai was destroyed by the eruption of its crater, which was heard at Niuafou, 160 miles distant, and it damaged the crops and trees at Vavau, 35 miles off. Ashes were thrown in large quantities on passing vessels 500 and 600 miles to the northeastward.

Discolored water.—The schooner *Elfriede*, in December, 1908, passed several patches of discolored water situated in latitude 17° 31′ S., longitude 173° 55′ W.

Niuatobutabu was discovered May 11, 1616, and named Keppel Island in 1767. This island (together with Tafahi and Niuafou) forms a portion of the Kingdom of Tonga.

When approaching from the southeast the island should be given a berth of 1 mile to avoid the shoals extending off it.

The larger Keppel Island is about 3 miles long, in a northeast and southwest direction, by about 1 mile in breadth. It has a general height of 90 feet, with a square-shaped hill in its center 350 feet high; from the northwestward the island has the appearance of a wide-brimmed hat. The center of the island is in latitude 15° 58′ S., longitude 173° 52′ W. The commander of the German naval vessel *Meurthe* in 1903 reports that the center of the island is in longitude 173° 45′ 45″ E.

West Island lies ¼ mile off the southwestern end of large Keppel Island, and is ¾ mile long and 70 feet high. The boat passage between the main island and West Island nearly dries at low water and is impracticable from an hour before to an hour after low water.

Twenty Feet Islet, 1 mile 274° from the northeast end of large Keppel Island, is an islet 20 feet high, standing on and close to the edge of the barrier reef.

The barrier reef extends about ½ mile off the northeast point of Keppel Island, and follows the line of coast to Twenty Feet Islet, where it extends ¾ mile offshore. It then takes a short curve in, and runs out again, forming an elbow about 1 mile offshore, from which the southwest peak of Keppel Island bears 133°, after which it curves in toward the west end of West Island, off which it extends about ½ mile.

No reefs were seen more than ½ mile offshore on the east side of Keppel Island, but a very dangerous reef lies 2 miles 325° of West Island, and connected with it by foul ground and patches. On no account should an attempt be made to navigate between this reef and Keppel Island.

A dangerous coral reef extends about 1 mile from the southwest extreme of Keppel Island.

Two casts of 15 fathoms, rock, have been obtained with the northern point of the center hill of Keppel Island bearing 212°, distant 4 miles.

Anchorage.—The best and most convenient anchorage is off the boat passage between West Island and Keppel Island, about 700 yards from the shore, in from 16 to 18 fathoms, fine sand and coral, with south extreme of Keppel Island bearing 130° and the summit of Keppel Island 71°.

Landing.—From the above anchorage a boat can communicate with the traders' settlement on the west extreme of Keppel Island by means of the boat passage above mentioned at all times of tide.

Traders.—The white inhabitants live at the southwest end of large Keppel Island, where there are two flagstaffs.

Tafahi or Boscawen Island (lat. 15° 52′ S., long. 173° 50′ W.), also one of the Tonga Group, was discovered and named Cocos Island on May 11, 1616, but was subsequently named Boscawen Island in 1767.

It is about 2,000 feet in height, bears 21° from Keppel Island, the nearest points of the islands being 5 or 6 miles apart.

Curacoa Reef, charted in latitude 15° 31′ S., longitude 173° 44′ W., was discovered in 1865. The reef appeared to be of small extent, and the sea was breaking heavily on it; soundings were not obtained when it was first discovered.

Curacoa Shoal, upon which soundings of 10 fathoms were obtained, with the center of Tafahi bearing 218°, is in latitude 15° 40′ S., longitude 173° 40′ W.

Niuafou, discovered August 3, 1791, and named Proby Island; it is also known as Good Hope Island. It is one of the Tonga Group.

This is a volcanic island, nearly circular, 3½ miles from north to south, and 3 miles from east to west; it is 588 feet high and well wooded to the summit. In 1895 there were nine villages on the seaboard and about 1,000 inhabitants.

The center of the island, an old crater, is a large lagoon, in which are hot springs, and traces of volcanic action are everywhere to be seen.

The volcano was again in eruption in 1886, when all the villages were destroyed, also many of the coconut trees and food plantations; it was seen in activity again in 1887.

No water except rainwater exists on the island, but in seasons of drought a small quantity of brackish water is obtained from one of the three small islets which exists in the great lagoon in the center of the island.

The northwest extreme, where the principal village is situated, lies in latitude 15° 34′ S., longitude 175° 41′ E. No bottom could be obtained with 130 fathoms of line 1 mile off this point.

Anchorage.—There appears to be no safe anchorage for large vessels. The schooners which trade to the island for the coconut oil anchor close off the village in 15 fathoms, but the anchorage is not good.

Landing.—The lava cliffs which surround the island on all sides render landing difficult in unsettled weather. The principal landing place is marked by a flagstaff near the village on the northeast side of the island under the lee of a jutting mass of rock; this landing should not be attempted with a fresh breeze from the northward; about 2½ miles from this to the eastward a large mass of lava rock projects about 80 yards and curves round toward another small projection of rock forming a snug boat harbor where, except at high spring tides, boats may lie in safety. From this landing place to the principal village where the governor lives is about 4 miles, the first part of the road being over sharp lava rocks and stones.

Another landing place at a village on the northwest side of the island. A mark on shore indicates the best position. (Landing would be governed by the season prevailing winds.)

REEFS EASTWARD OF TONGA GROUP.

Buffon Reef.—In 1880 the French bark *Buffon* reported that after passing Beveridge Reef at noon, at 2 o'clock the following morning came in sight of heavy breakers and barely escaped being wrecked on a reef, the position of which, based on that of Beveridge Reef, is latitude 20° 39′ S., longitude 169° 58′ W., or about 90 miles south of Niue Island. This reef was not seen from the French ship *Aube* in 1899.

Beveridge Reef (lat. 20° 02′ S., long. 167° 49′ E.), also called Nicholson Island, is a lagoon reef, and when first reported in 1833 the sea was breaking on it in many places. It is described as having an outline similar to that of a coral atoll, having an entrance on the northwest side. The mass of shallow water appeared to be contracted at its southwest extremity, but no rocks above water were seen. The southwest extremity was determined to be as given in the margin.

Harans Reef.—From circumstances which have come to light there appear to be grounds for entertaining belief in the existence of a reef in the position reported by the ship *Thomas Dickenson* in 1842. The reef was passed at night, and the sea broke furiously over it, apparently for about two ship's lengths. Position as given, latitude 21° 32′ S., longitude 168° 54′ 30″ W.

Another report, though vague, gave the position of the reef as latitude 21° 43′ S., longitude 167° 45′ W.

The reef was expunged from the charts in 1874, but in consequence of a reconsideration of the evidence it has been replaced on the charts as P. D. in the position first mentioned.

Antiope Reef (lat. 18° 14′ S., long. 168° 20′ W.).—The master of the British ship *Antiope* reported the existence of a sunken coral reef, situated about 90 miles in a northeasterly direction from Niue or Savage Island.

The *Antiope* on May 10, 1886, the weather being fine and clear, with a light breeze and long swell, passed within a ship's length of the reef which was estimated to be about 400 yards long north and south and 100 yards wide, the formation and shape of the reef being clearly visible from aloft. The sea broke heavily over the center of the reef.

Reef.—A reef with an estimated depth of from 10 to 12 feet, marked by discolored water, and about 3 miles in extent in an east-southeast and west-northwest direction, is reported to be situated in latitude 20° 53′ S., longitude 172° 4′ W.

A rock was reported (1890) from the Norwegian bark *Ringhorn* to be situated in latitude 18° 6′ S., longitude 168° 30′ W.; this is considered to be indentical with Antiope Reef.

Ten miles south of the reef the depth is 2,735 fathoms.

Niue (Savage) Island (lat. 19° 10′ S., long. 169° 47′ W.), which is (1900) under the protection of Great Britain, was discovered June 20, 1774, and was named Savage Island, in consequence of the ferocity of the early inhabitants.

The island is of coralliferous limestone formation, that has subsequently been raised or upheaved; it is about 30 miles in circumference, it is formed of thickly wooded hills about 200 feet high, and skirted with enormous caverns, some of which extend a considerable distance inshore; it is surrounded by a fringing reef and steep-to.

There are five principal villages, Avatele and Makufu on the south, Mutalau on the southwest, Alofi on the west, and Liku on the east.

Niue is under independent native rulers. A missionary with his family resides at Alofi (1895).

The population in December, 1895, numbered 4,500, and is decreasing; the number of females is in excess of that of the males. The island is generally healthful and free from epidemics. Cutaneous diseases and opthalmia are common. One of the greatest pests is the flies.

The form of government is republican and extremely crude. The chiefs have general monthly meetings; at these meetings the laws are made.

The natives are good-tempered, cheerful, and industrious. They are quite different in appearance to the natives of the Cook Islands, being smaller and darker in complexion, and speak a language entirely of their own, more allied to the Samoa dialect. They are all Christians.

It is worthy of remark that the Niueans were never cannibals, nor did they offer human sacrifices, or worship idols; their ancient customs was to deify one of ther chiefs, and at his death to select another of their warriors for the same purpose.

Alofi anchorage—Beacons.—In Alofi Bay two white beacons with white diamond-shaped heads, with a black horizontal bar across, have been erected near the landing place; the lower one is on the reef in front of—the upper one is on the face of the cliffs behind—the landing pier.

There is good anchorage in 20 fathoms, fine gravel, sand, and coral, about 350 yards from the breakers with the beacons in line 88°. The boat passage is marked by two small perch beacons; on either side there is a small iron pier at the head of the passage.

Water is scarce, and for drinking purposes is obtained from deep fissures in the rock 2 miles inland.

There is another trading station at Avatele, distant about 5 miles to the southward. There is good anchorage off it, except with westerly winds.

Communications.—The missionary steamer from Sydney calls twice a year, in May and October; also, another steamer from that port in April, August, and November. These carry the produce to Apia, or Sydney, which consists of cotton, fungus, and coconut fiber.

Cloth, calico, knives, axes was latterly the medium of exchange. Money is now in general use.

ISLANDS, ETC., NORTHEAST OF FIJI.

HORNE ISLANDS.

Fotuna (lat. 14° 06′ S., long. 178° 10′ W.).—The Horne Islands were discovered May 19, 1616, and are under the protection of the French. Fotuna Island is 8¼ miles long and 5 miles broad and attains a height of 2,500 feet in Mount Schouten, the highest point. The northwest coast appears bold and precipitous; on the south side numbers of coconut trees are seen on a low projecting point. Water and provisions in abundance may be procured.

The island is reported incorrectly charted.

Sigave Bay is situated on the southwest side of the island and is comparatively easy of access, but some sunken patches of coral render the services of a pilot advisable.

The bay is about 250 yards wide at the entrance between the reefs and 600 yards deep; it is open to the southwest but sheltered from all other winds.

A white chapel stands on a hill on the south side of the harbor and is a guide to the bay. The anchorage is on a sandy bottom, with 6 to 8 fathoms, from 100 to 200 yards from the shore; at 400 yards off there are depths of 18 fathoms.

Directions.—In approaching the bay one can easily make out among the hills the track of a cascade, generally dry. A little later a European house will be seen on the beach, on the right of which are two small sheds with zinc roofs, and farther on native huts. A bushy tree marks the shed with zinc roof. Keeping the before-mentioned cascade over the right side of the tree 25°, one follows nearly the center of the channel into the bay, anchoring in 12½ fathoms.

A chain secured around a 7-foot high rock on the reef on the eastern side of the bay has a shackle on the other end and is useful for securing the stern of a vessel anchored off it.

Sain Channel, between this island and Alofa, is about 1 mile in width between the reefs; a southwest and northeast course leads through. The tides were neap, but what current there was appeared to set directly through. Sixty fathoms have been obtained in the middle of this channel.

Northeast side of Fotuna.—A large village with a church are situated on the northeast side of Fotuna in coconut and breadfruit tree groves extending 4 or 5 miles along the coast, the entire length of which is fringed by a flat shore reef, on which the surf breaks heavily with the prevailing wind. The ships' boats were unable to land. Canoes passed readily through the surf with passengers, but in returning to the boats they were repeatedly swamped.

Alofa Island (lat. 14° 18′ S., long. 178° 04′ W.), to the southeast of Fotuna, and separated from Fotuna by Sain Channel, is about 6 miles long in an east and west direction and 3 miles broad; the highest point is about 1,200 feet in height. There is sheltered anchorage from the prevailing wind and sea in 19 fathoms off Mua, in Sain Channel, with Green Point bearing 100°. The anchorage which is sheltered by the reef that extends from the northeast point of Alofa may be recognized by a large black rock on the coast reef, which may be seen from far off. This reef does not appear on the plan.

A ridge of rocks extends ½ mile 122° from Rocky Point, the eastern extreme of the island.

UEA OR WALLIS ISLAND.

Uea was discovered August 16, 1767, and it is probably the same that was seen by Maurelle in 1781. It consists of one principal island and several smaller islands and islets surrounded by a barrier reef, through which there are three channels, the southern one being the best and that which hitherto has been solely used.

The exports consist of copra, about 500 tons annually, and small quantities of beche-de-mer and pearl shell.

The French Government assumed a protectorate over these islands in 1887.

Uea, the largest island, is 470 feet high near the center, at Mount Lulu, and covered with vegetation. It is divided into three parishes—Mua upon the south, Lano upon the north, and Mata Utu upon the east. The village Mata Utu is the capital. The population are Roman Catholics.

A natural curiosity of this island is a lake, evidently an old crater, half full of water, having subterranean communication with the sea as it rises and falls with the tide.

There are good roads all over the island.

The mission station at Mua is in latitude 13° 20′ 40″ S., longitude 176° 10′ 00″ W. (approximate). The longitude of the church at Mata Utu is 176° 11′ 09″ W.

Pilots.—Native pilots from Mua will board the vessel off Honikulu Pass. Too much confidence must not be placed in them, for they are unaccustomed to other than small craft. The reefs can be seen from aloft under favorable circumstances with the sun astern.

Supplies.—Pigs and poultry may be readily obtained; also yams and coconuts are abundant. Water is scarce.

Nukufutu, the north rock, is 150 feet high and most conspicuous, being of a very dark color. When seen from the northeastward it appears peaked, and when bearing 100° castle shaped.

Fungalei Island, one of the eastern islets within the barrier reef, is about 200 feet high, with a saddle-shaped top.

Honikulu Pass.—The southern opening in the barrier reef leading into Mua (Allier) Bay is that solely used by vessels.

The channel is easily recognized, being west of Fenua Fu Island, the southernmost of the group, the fringing reef of which extends about 200 yards westward and forms the eastern side of the pass. The reef on the western side is reported to extend southward from 400 to 600 yards farther than shown on the plan.

Directions—Beacons.—The track recommended is shown by a peaked line. The services of a pilot are necessary. To enter, bring the rock at the southeastern point of Nuku Aeta to bear 33° and in line with the beacon on the crest of the hills ½ mile to the west of Mataloa Point, which mark will lead in. The beacon consists of a 20-foot wall surmounted by a white pyramid. This mark is not very easily seen from afar. It should be sought for on the crest of the hills of Mataloa Point.

The best time of tide for entering was considered to be the slack water after ebb, as the edge of the reefs to seaward are barely visible at high water. Care should be taken to give the north point of Fenua Fu Island a berth of at least 300 yards. Upon the ebb tide there are strong eddies, which must be crossed with the vessel well under command, the stream appearing to set directly on to the northeast corner of the western reef. On the flood stream the eddies are scarcely noticeable.

The tidal stream runs in the pass at the maximum rate of 6 knots; slack water lasts about 15 minutes.

Caution.—Vessels should keep on the leading mark recommended for some time, both before entering and after leaving the passage, as the depths outside the barrier reefs are very irregular.

Nuku Aeta, lying just inside Honikulu Pass, is about 200 feet high, rugged, and conspicuous and surrounded by a fringing reef on which there are several rocks and islets. The rock at its southeast extreme is painted white, as above stated.

A shoal of 2 fathoms lies 400 yards 76° from this small rock and just northward of the track recommended. It may be distinguished by the green color of the water. Also, a rock, which dries, lies 200 yards 116° from the same small rock above mentioned.

Nuku Akimua (Sail Rock) lies 1.3 miles 36° of Fenua Fu Island, in the entrance. It is about 15 feet high and has the appearance of a boat under sail.

Mua (Allier) Bay anchorage.—When bound for this anchorage and well within Honikulu Pass, steer for the north point of Faioa

Island. When Nuku Akimua bears 346° and the southeast point of Nuku Aeta Island 256° anchor in 22 fathoms, sand and coral. This anchorage is, however, inconveniently far from the shore.

Faioa, bounding the eastern side of Mua Bay, is one of the largest islets on the barrier reef. It is low and covered with coconuts.

Mua anchorage.—There are two channels to this anchorage near the settlement, one to the east, the other to the west of Nuku Akimua. The eastern one has been recommended.

Great caution is necessary when proceeding to the inner anchorage off Mua. The native pilots will be found useful, although no altogether trustworthy.

Both these passages are narrow and intricate. A study of the plan, together with a local pilot and a good look-out from aloft, will be a good guide.

Mua anchorage.—A less intricate channel to this anchorage than that described will be found by continuing on the track from Honikulu Pass to Mata utu Bay until the church steeple at Mua comes in line with the eastern side of a house with red roof, bearing 297°, which leads to the eastern entrance of Mau anchorage.

Landing is difficult at low water.

Mata Utu Bay, 3 miles northward of Mua Bay, can be reached by a narrow but deep channel (in which the tide runs 4 knots) near the north extreme of Faioa Island.

A rock, with a depth of 2½ fathoms on it, is situated at the northern end of Faioa Pass, with Mataloa Point bearing 270°, distant 1,800 yards, and Finekovi Point 209°.

Anchorage.—The following beacons mark the channel to Mata Utu anchorage from Mua Bay; they are red to starboard and black to port on entering.

A red conical beacon with conical topmark on the edge of the reef, south end of entrance to Faioa Pass, 700 yards westward of the north end of Faioa Island.

A black conical beacon with cylindrical topmark on the northwest side of the pass and 200 yards 335° from the last-mentioned beacon.

A red conical beacon with conical topmark at the southwest corner of the Fatuvaka Reef, about 3 miles northward of the above.

A black conical beacon with cylindrical topmark on the southwest side of the Fatuvaka Channel, and 300 yards 212° from the preceding beacon.

A black conical beacon with cylindrical topmark on the northeastern end of the reef northwestward of Fatuvaka Reef.

A white triangular beacon on an elevation 340° from the church at Mata Utu. This last beacon was not standing in June, 1902. The church at Mata Utu 341° midway between the two beacons of the Fatuvaka Channel, is an equally good mark.

The anchorage is between the reefs northwestward and northward of Fatuvaka Reef, in 10 to 15 fathoms, but small vessels of less than 18 feet draft can go farther in toward the pier and anchor with the church bearing 291° 1,300 yards.

A local pilot and a good lookout from aloft are the best guides, the weather should be clear and the sun in the southeast.

Landing is easy at high water a little north of the church.

Two miles northward of Matu Utu the channel is completely obstructed by sand banks.

Winds and weather.—During the months of June, July, and August the prevailing winds are between east-southeast and north-northeast. Breezes from the north or north-northwest are accompanied with squalls and rain.

Tides.—It is high water, full and change, at 6h. 40m.; springs rise 6 feet. In Mata Utu Bay the tide flows 4 hours and ebbs 8 hours. The sea washing over the barrier reef sometimes makes the tide irregular.

DETACHED BANKS.

Lalla Rookh Bank is 3½ miles long northeast and southwest, with an extreme breadth of 1½ miles.

The northeast end of the bank has general depths of 10 to 14 fathoms, over a sand and coral bottom.

The central portion of the bank is slightly deeper than the rim, but this difference is not marked. From the edge the soundings drop down steeply to depths between 200 and 300 fathoms.

On this bank (October, 1897) the current was found to set between west-northwest and south-southeast, from a half to 1¼ knots.

The southerly set was most pronounced between 3h. and 8h. after high water at Uea or Wallis Island.

Home Knoll (lat. 12° 55′ S., long. 175° 36′ W.) is a small coral knoll, extending east and west about 1 mile between the 100-fathom limits by little more than ½ mile in breadth, with a least depth of 10 fathoms and general depths of 12 to 16 fathoms over a sand and coral bottom.

Its center is situated 1 mile eastward from the northeast end of Lalla Rookh Bank, with depths of from 200 to 300 fathoms between.

The 1,000-fathom line encircles the two banks, Lalla Rookh and Home Knoll at distances varying from 1½ to 3 miles.

Pasco Bank (lat. 13° 04′ S., long. 174° 37′ W.), reported by several vessels as situated between Savaii and Wallis Islands, is 5 miles in width at its eastern end, from whence it extends nearly 20 miles in a westerly direction, narrowing to a width of 3 miles in its center, westward of which it contracts to a breadth of ¾ mile, thence broadening out and forming a narrow ridge.

The general depths in the center are from 20 to 27 fathoms, sand and coral, with a shallow rim of growing coral running around its outer margin, having depths of 8 to 10 fathoms on it. The shoalest soundings, 7½ fathoms, were found on the southern edge of the bank, where it is most contracted in width. On all sides it drops down steeply into depths of from 200 to 400 fathoms.

The current in October, 1897, was found to set from northwest to southwest from a half to 1¼ knots.

Siafiati Bank.—The master of the schooner *Siafiati* reported in 1906 having passed over about 2 miles of shoal water, the bottom being plainly visible, the depth about 16 fathoms, in latitude 12° 14′ S., longitude 175° 30′ W.

Field Bank.—Its eastern extremity is situated in approximately latitude 12° 16′ 45″ S., longitude 174° 43′ 30″ W., and the bank thence extends west-southwestward 6½ miles, with a breadth of 2½ miles toward the center and contracted at the eastern end to a narrow ridge, which is 2 miles long and barely ½ mile in width.

The least water found was 13 fathoms, situated on its northern edge; the general depths over the shallow rim encircling the bank range from 14 to 16 fathoms, and the depths in the center from 18 to 21 fathoms, over a sand and coral bottom.

The edge of the bank drops steeply on all sides into depths of from 200 to 300 fathoms.

It lies 223°, distant 14 miles, from Taviuni Bank, with depths of upward of 1,200 fathoms between.

Taviuni Bank, originally reported by the schooner of that name, is a small oval-shaped bank of sand and coral, 2 miles long, east and west, within the 100-fathom limits, and upward of a mile broad.

Its center is situated in latitude 12° 06′ S., longitude 174° 34¼′ 15″ W. The least water found was 9 fathoms, the depth over the greater portion of the bank ranging from 11 to 14 fathoms.

Outside the 20-fathom line it drops steeply to depths of over 100 fathoms, the 1,000-fathom line maintaining a distance of 2 miles from it all around.

The current in September, 1897, was setting northwest at about half a knot per hour.

Robbie Bank (lat. 11° 03′ S., long. 176° 53′ W.), originally reported by the master of the schooner *Taviuni* in 1888, is nearly circular in shape, 8 miles in diameter, and situated with its center as stated in the margin.

It is composed of sand and coral and is of the usual atoll-like formation, which is such a common feature in all these banks, having general depths of 26 to 29 fathoms over its central portion, with a shallower rim running around the edge of growing coral about 1 mile in width within the 20-fathom line, with depths of 10 to 15 fathoms over it.

The shallowest part is on the northwestern edge, where this rim rises to depths of 7 and 8 fathoms for a distance of about 2 miles along its circumference.

The edge of this bank drops steeply on all sides within a very short distance to depths of from 200 to 300 fathoms.

While at anchor on this bank (November, 1897) the current was observed to vary considerably. East and southeast currents from ½ to ¾ knot, occasionally setting to windward against a fresh east-northeast wind.

Adolph Knoll, originally reported by the German schooner *Adolph,* is a small coral bank, 1 mile in extent, rising steeply from depths of 300 to 400 fathoms, with a least depth of 16 fathoms on it on its western side.

Its center, situated approximately in latitude 11° 54′ S., longitude 178° 10′ W., and it bears 144° distant 3 miles from Tuscarora Bank, with depths of from 300 to 400 fathoms between.

Tuscarora Bank is situated with its center in approximately latitude 11° 48′ 45″ S., longitude 178° 14′ 00″ W.

It is 10 miles long east and west and about 6 miles broad, having depth of 26 to 29 fathoms, sand and coral, over its central portions, with a shallower rim of growing coral, over which the general depths are 20 to 22 fathoms.

On the southwestern edge there is a shallower patch of 14 fathoms, and on the northern edge a patch of 16 to 18 fathoms. The bank drops steeply on all sides into depths of more than 200 fathoms.

While at anchor on this bank (November, 1897) the current was observed to vary in direction between west-northwest and south, with a rate of from ¼ to 1 knot. The southerly current commenced with great regularity each day three hours after the moon's passage and continued for six hours, showing that these variations are due to tide.

NOTE.—When these banks were examined by the British naval vessel *Penquin* there was no single instance when the presence of any of these banks was detected from the masthead, although the conditions for doing so were usually favorable, and in addition to the ordinary "lookout," a Fijian, familiar with the appearance of coral water, was always stationed at the masthead.

Isabella Bank, on which a depth of 12 fathoms, coral, was found, is circular in shape and about 2 miles in diameter. Its center is approximately in latitude 12° 24′ S., longitude 177° 26′ W.

Waterwitch Bank, situated between the parallels of 12° 29′ and 12° 34′ south latitude, and the meridians of 176° 41′ and 176° 50′ west longitude, is of atoll-like formation, having a narrow rim of growing coral, with soundings of from 12 to 16 fathoms, all around its outer edge, and depths of 23 to 28 fathoms inside.

Combe Bank (lat 12° 26′ S., long. 177° 35′ W.), about 11 miles in length, east and west, and maximum breadth of 5 miles, is a coral bank with from 14 to 22 fathoms over it. The soundings on this bank were not sufficient to decide whether it is of a similar formation to the Waterwitch Bank, but the shoaler soundings are near the outer edge.

Current.—While the three above-mentioned banks were being sounded in September, 1895, a slight current setting to the west-northwest was experienced. With a fresh trade wind this set was much increased and there was a troublesome sea in the neighborhood.

Bayonnaise Bank was discovered in 1828 and soundings of 16 fathoms obtained, coral bottom, latitude 12° 08′ S., longitude 179° 43′ W.

Depths of 25 fathoms, coral bottoms, were obtained by the *Herzogin Sophie Charlotte*, in 1908, on the northeastern edge of this bank, which was found to extend within the 100-fathom curve for about 20 miles, in a northeast and southwest direction, with a breadth of about 10 miles.

A bank of from 15 to 17 fathoms, and probably less, extending about 4 miles in an east-northeast and west-southwest direction, was reported, in 1911, by the German vessel *Hera*, to be situated 27 miles eastward of the shoalest part of Bayonnaise Bank.

Rotumah Shoal, about south by east 80 miles from Bayonnaise Bank, was reported in 1894 to be in latitude 13° 25′ S., longitude 179° 21′ W., a depth of 12 fathoms was obtained; near this shoaler water was seen.

SAMOA OR NAVIGATOR ISLANDS.

The whole of the group, with the exception of Rose Island, is of volcanic origin, and has the remains of inactive craters. The islands are surrounded in most cases by coral reefs, within which the harbors are situated; the principal of which are, Apia and Saluafata in Upolu Island, and Pago Pago in Tutuila Island. Apia is the capital of German Samoa. Pago Pago is the capital of American Samoa.

To those requiring them, these islands offer abundant supplies of water and provisions; they are also well suited for tropical-productions, and ther is a great quantity of rich level land in all of them.

Trade.—Copro cacao; lately much rubber has been planted. Cattle breeding is also extensively carried on. On the mountains both wild cattle and pigs are to be found in abundance; some of the wild boars are extremely ferocious.

Communications.—The mail steamers of the Oceanic Steamship Co., running between San Francisco and Sydney, call once a fortnight. The Union Steamship Co. of New Zealand also run a regular service every four weeks from Auckland and Sydney connecting with Canadian Pacific Co.'s steamers for Vancouver at Suva, Fiji Islands.

The climate may be considered variable. The mean temperature of the winter and summer months is 78° and 83°, respectively. The mean yearly temperature is 80°. The mean height of the barometer for the year is recorded as 29.896 inches.

Winds and weather.—The summer (November to April) is distinguished by variable, light east winds, often interrupted by calms; at this period westerly winds are also experienced, sometimes with rain squalls, and sometimes in heavy storms, always accompanied with rain.

From the middle or end of April to November, fresh trade winds occur, especially in the first half, rarely interrupted by calms and southwest winds.

The months July, August, and up to the middle of September, are distinguished by cool southeast winds, which frequently blow in violent squalls. In the last half of the winter the trade wind is not so sharp, and is often interrupted by calms. and light westerly winds, while at a distance from the island it constantly blows with equal strength and only gets lighter during the night.

Near the land, from daybreak to 8, 9, and even 10 a. m., there is a calm; at this time the breeze begins to be felt, slightly ruffling the sea, up to about 2 p. m., when it reaches its greatest strength; from 2 to 3 p. m. it gradually decreases, and at sunset ceases entirely; then a light breadth from the land commences, which becomes stronger at about 1 to 2 a. m., and ceases again at about 6 a. m. The land breeze is felt at 2 to 4 miles from the land. Such is the general state of the winds during the trade wind season on the coasts; but it is often disturbed by stronger currents both by day and night, and stiff east, southeast, and south-southeast winds blow for some time, and the land wind is not felt at night while these strong winds blow.

Hurricanes occur, especially in from January to March or the middle of April; they commence with a violent northeast wind, which passes through north and west to southwest. These hurricanes are caused by conflict of the northwest winds with the trade winds, and their beginning and ending are accompanied by frequent electrical phenomena.

Although the hurricanes do not occur very frequently at Samoa, it is probable that they are frequent between it and the Tonga Group, when scarcely a season passes without one occurring. In April, 1850, in January, 1870, again in March, 1883, Upolu Island was devasted by them.

In these cases they completely destroyed the coconut, banana, and breadfruit crops, reducing the natives to the verge of starvation for several weeks.

In March, 1889, Samoa was visited by a hurricane of exceptional fury. In Apia Harbor the American naval vessels *Trenton* and *Vandalia* were wrecked and the *Nipsic* stranded. The vessels *Eber* and *Adler*, of the Imperial German Navy, were also wrecked, and the *Olga* stranded, and 130 lives were lost. The only vessel that escaped being the British naval vessel *Calliope*, which had sufficient steam power to proceed to sea, though she had a very narrow escape.

The barometer commenced falling on the 13th, and on the 14th the wind set in from south-southwest with violent qualls and rain. About midday on the 15th the barometer showed its lowest reading of 29.1 inches, and the wind shifted quickly to northeast and to north and northwest on the 16th, throwing a tremendous sea into Apia Harbor; the wind moderating on the morning of the 17th.

Apia had also experienced a hurricane in February, 1889, and early in March heavy gales from northeast and northwest.

Rain.—The rainy season is from December to April, but is often interrupted by fine clear weather. At this period the climate is very damp, and the roads are covered with stagnant water. Rain is not limited to summer, but occurs during winter. An amount of 106 inches has been measured in one year. Hail never falls in Samoa. Dew is heavy during the summer months.

Volcanic disturbance.—Earthquakes occur occasionally, but as yet have not caused much damage; however, during the hurricane of March 26, 1883, all the vessels that were in Apia Harbor, Upolu Island, except one small schooner, were driven out to sea and lost; this being attributed to a number of heavy waves caused by an earthquake. On shore, several houses were seriously damaged, and trees uprooted.

The tides are semidiurnal, and, considering the small rise and fall, they are very regular. The following data depend upon the observations of 33 consecutive tides at Pago Pago Harbor, Tutuila Island.

Mean time of high water at full and change, 7h. 11m.; mean rise and fall of spring tide, 3 feet 4 inches; mean rise and fall of neap tide, 2 feet.

The flood stream sets to the westward.

Current.—On the north coast of Upolu, during the trade wind season, the current sets northwestward; at other times variable in direction and depends on the force and direction of the wind. On the south coast the current sets to the eastward.

Near the coast of Tutuila, especially during northeast winds, the current sets southwest; as much as 4 knots per hour has been experienced. Between Upolu and Tutuila, from August to December, the current has been found to set northwest, averaging four-tenths of a knot per hour.

When bearing to the eastward it will be found an advantage to keep on the southern side of the group, where there is not only a favorable current, but there the winds will be found more regular and calms less frequent.

Rose Island (lat. 14° 32′ S., long. 176° 11′ W.), the easternmost of the Samoa Group, was discovered in 1819. It is 75 miles eastward of Manua Islands, and is a circular atoll nearly 3 miles in diameter, with a lagoon in the center. There are two islets on its eastern side; the northern is merely a sand bank without any vegetation, the southern islet is wooded and about 33 feet high; they are not inhabited. There is a narrow passage for boats into the lagoon on the northwest side, with a depth of 6 feet. Inside, the depth is 7 or 8 fathoms, with two coral banks near the southwest part of the lagoon.

The flood-stream sets northeastward, the ebb southwestward; the rise is about 4½ feet.

Manua Islands (lat. 14° 14′ S., long. 169° 34′ W.) consist of three islands, which are all high, extending in an east-southeast and opposite direction for 12½ miles. The population numbers about 2,000.

The group is clear of dangers as far as is known, and harbors may be approached with some boldness.

Tau Island, the largest of the group, is in the form of a dome, rising to the height of 2,500 feet; it is about 14 miles in circumference and covered with a luxuriant vegetation and has many coconut groves on its northwest side. The principal village, named Tau, is on the west side of the island, where there is an anchorage near the shore with a cove for landing. In the line between the two heads the depth is 34 fathoms.

Faleasau Bay, on the northwest side of the island, affords tolerably sheltered anchorage in 15 fathoms during the trade wind, but a vessel should be prepared to weigh with any change.

The landing place is a very narrow passage through the reef, only wide enough for a boat, and is dangerous if there is any swell on.

The natives are willing to trade, and pigs, fowls, sweet potatoes, fruit, etc., are procurable.

Many streams are seen coursing down the side of the island.

Submarine volcano.—On September 12, 1866, dense masses of smoke arose from the sea between Tau Island and Olosinga Island and continued till the middle of November. The outbreak was preceded by repeated shocks of earthquakes. The depth of water (1895) over the volcano was 25 fathoms or less, and reported to be shoaling; the water was previously deep.

Olosinga Island, 3½ miles 291° of Tau Island, is a narrow ledge of rocks rising nearly perpendicular on both sides; it is 1,500 feet high and about 1 mile in length; the coral reef surrounding it has apparently been upheaved 15 or 20 feet, as it consists of two regular shelves, one beyond the other. Vessels can anchor in a depth of 15 fathoms in Sili Road, northward of the channel separating Olosinga and Ofu Islands, and landing is difficult at low water on account of the fringing reef.

Ofu Island, 2½ miles in length in an east and west direction, lies westward of Olosinga, and is separated from it by a boat passage ¼ mile wide.

There is the small islet named Foisina off the western side, near which is an anchorage.

Tutuila Island (lat. 14° 16′ 30″ S., long. 170° 34′ 30″ W.).—This island is high and of volcanic appearance, 17 miles in length and 5 miles broad in its widest part, the western end is the lowest and most cultivated. There are several anchorages on the north coast, where wood, water, and supplies may be obtained, but the best and safest harbor is Pago Pago, on the south coast, which is well adapted for refitting.

The population of Tutuila and Manua was about 6,000 in 1901.

The United States always keep a naval vessel here and a naval officer acts as governor. s/

Off-lying shoals.—A shoal of from 6 to 8 fathoms lies from 1 to 1½ miles 212° of Rocky Point, at the southwest extremity of Tutuila Island.

A shoal with 6 fathoms water lies about 12 miles 88° of Cape Matutula, off the east end of Tutuila Island.

A shoal, 4 fathoms (1880), about 25 miles 158° of the entrance of Pago Pago Harbor, Tutuila Island. This shoal, and also that above mentioned, lying 88° of Cape Matutula, could not be found by the U. S. S. *Mohican*, 1890.

A rock (E. D.) is charted 15 miles 181° from Sail Rock Point.

Taema Shoal, lying off the entrance of Pago Pago, is 3 miles long east and west, and from ½ to 1 mile wide; the western extremity bearing 178° from Breaker Point, distant about 1½ miles; the least water (4½ fathoms) over which the sea breaks in bad weather is on this end of the bank, and is the only danger to be avoided outside the shore reefs.

Peiva Peak (1,470 feet) in line with and seen over Breaker Point 23°, leads in midchannel through the passage between Taema Bank and the reef off Double Point.

Taema Shoal should be avoided, even in fine weather, by vessels drawing over 12 feet.

Aunuu Island is situated 1 mile southward of Red Point, the eastern extreme of Tutuila, and is 65 feet in height. The island has two peaks, and at its western end is a village with coconut trees and a Protestant mission.

Light.—A fixed red light 250 feet high, visible 9 miles, is exhibited on the northeastern point of Aunuu Island; it is exhibited from a white tower 14 feet in height.

Nafanua Shoal extends 3 miles westward of Aunuu Island, with depths of 5½ to 7 fathoms, and is steep-to.

When making Pago Pago Harbor from the northward under steamers, generally pass between the above-mentioned dangers and Tutuila.

Narragansett Passage, nearly 2 miles wide, with very deep water, is the channel between Nafanua and Taema Shoals.

Breaker Point, bearing 296°, leads through Narragansett Passage.

Fagaitua Bay is situated northward of the west extreme of Nafanua Shoal. Round Bluff Rock is on the eastern side of this bay; by keeping ½ mile from the shore this danger will be avoided.

In this bay there are a few coral reefs, and it should be entered cautiously.

A wharf 280 feet in length with a depth of 33 feet alongside has been built here near Observatory Point. The observatory is on the summit of Bethune Point, 165 feet above the sea.

Pago Pago Harbor—General remarks—Aspect.—This harbor is situated on the south side of Tutuila. Deep approach, available for largest vessels at all times of tide.

Good and sheltered anchorage in depths of from 6 to 25 fathoms, mud and sand bottom, excellent holding ground, over a space 1 mile long and 400 yards broad. When making this port the following landmarks are not easily mistaken: The small island of Aunuu, about 65 feet high, at the eastern end of Tutuila; Sail Rock Point, the southern point of the island, 5 miles southwest of Breaker Point, the eastern point of entrance to Pago Pago; the sharp Peak Matafao, 2,133 feet high (the highest point of the island), on the west side of the port; the flat, dome-shaped Peak Peiva, 1,719 feet high, on the east; and Tower Rock, under Distress Point, the western point of entrance, and within the shore reef, with its perpendicular sides rising to a height of 102 feet and its summit covered with verdue.

The shore reefs extend from 100 to 200 yards from the beach; they are perpendicular or shelving on their outer edges and are awash at low water. The surf breaks over them, distinctly marking their outline.

Lights.—A fixed white light, elevated 188 feet and visible from a distance of 12 miles, is exhibited from Breaker Point; it is shown from a white tower 16 feet high on the highest point of the bluff.

Two fixed red leading lights 343° and 163°, 330 feet apart, have been established on the northern shore of the harbor. The front light is elevated 75 feet, and shown from a white tower 11 feet high situated near the Catholic mission.

The rear light is situated 100 yards 343° from the front light and is exhibited, and at an elevation of 150 feet, from a white tower 8 feet high surmounted by a white fan-shaped structure.

They are both visible from a distance of about 9 miles.

A red lantern light (private) is shown from the end of the pier in front of the customhouse and marks the boat landing.

A light is hung on the arm of a beacon erected on the northern edge of the reef by Goat Island on the nights that the Oceanic Steamship Co.'s steamers are expected. At the same time lights are placed on the Whale Rock Buoy and the Mooring Buoy for the vessel. These are private lights.

Coal.—The United States has a coal depot at Pago Pago. The commandant is only permitted to supply foreign vessels with sufficient coal to enable them to reach the nearest port at which coal could be procured.

The coal is stored in a large steel shed capable of holding 5,500 tons. The coal shed is filled with tramways, trolleys, and venilators, and trucks with capacity of 2 tons each.

In front of the coal shed is a substantial wharf 100 yards in length, with a depth of 30 feet at each end.

Water.—A reservoir has been built above the naval station, holding 120,000 gallons of water constantly supplied. The water is brought down to the wharf in pipes.

Governor's residence.—The governor's house stands on an eminence at Observatory Point.

Whale and Grampus Rocks, both of coal formation, are situated in the harbor entrance. Whale Rock is about 100 feet in diameter and has 12 feet water; it is marked by a black buoy. The sea breaks over the rock in bad weather, otherwise it is not easily seen. There is a clear passage 300 yards wide between the rock and Blunt Point, with from 25 to 30 fathoms water.

Grampus Rock bears 40° about 500 yards distant from Whale Rock. It is about 20 yards in diameter, has 8 feet water, and is sometimes marked by a red buoy. There is a narrow passage between it and the shore reef, but it should not be taken except in case of emergency.

There is a sunken rock 338° about 800 yards from Grampus Rock, but it is well marked by the surf, which breaks on it continually.

Beacon.—The edge of the reef extending northeastward from Goat Island is marked by a beacon surmounted by a staff and cylinder.

A beacon, with staff and cylinder, is placed at the end of the reef which extends from the west end of Fanga Tonga (Fagatoga) Bay.

Shoals.—The shores of the harbor are fronted by rocks and reefs which on the western side of the extrance extend to 1,200 yards eastward of Fagaalu; the head of the harbor is obstructed by rocks extending nearly 1,200 yards eastward of Pago Pago.

Directions.—Having rounded the east end of Tutuila and entered the channel midway between Aunuu and Red Point, steer about 250° until abreast Round Bluff, keeping a sharp lookout to avoid the reef extending 670 yards off the bluff; then 267°, heading for the peak Matafao, keeping Tower Rock a little open on the starboard bow until up with Breaker Point.

To enter the harbor steer in with the range lights in line bearing 343°, which lead between Whale and Grampus Rocks.

There is good anchorage anywhere in the inner harbor in from 6 to 25 fathoms water, blue mud and sand bottom, excellent holding ground. The best anchorage for large vessels is off Fanga Tonga in 20 fathoms water. Vessels of 1,000 tons and upward should not anchor in less than 16 fathoms, as the harbor becomes narrow for long vessels to swing at single anchor.

A good working vessel may beat out against the trades, but the harbor is narrow and lined with coral reefs on both sides, and after passing Goat Island a heavy swell will often be encountered; therefore it would generally be preferable to go out with the land breeze, which usually blows from 2h. to 5h. or 6h. a. m.

Buoys.—Four mooring buoys are established in the harbor.

The only difficulty in going out with this wind is the liability of losing it before getting sufficiently clear of Breaker Point to allow a vessel to wait for the trade wind to come in without the disagreeable necessity of anchoring in from 35 to 37 fathoms water. The surf always breaks heavily on Breaker Point and on the reef outside Distress Point, and if the vessel loses the wind before getting clear of these points anchor at once.

During the months from November to April westerly winds are frequent, and then sailing vessels can get out without difficulty.

Supplies.—There is a great dearth of fresh provisions here, but fruits, bananas, oranges, pineapples, etc., are plentiful. Ice may be obtained.

Communication.—The packets of the American and Australian lines call at Pago Pago. There is a regular service every three weeks, either from San Francisco or from Sydney via Auckland. A steamer runs between Apia and Pago Pago.

Tides.—It is high water, full and change, at 7h. 10m.; springs rise 4 feet.

Standard time at Tutuila is that of the meridian 172° 30′ W. from Greenwich.

The coast from Sail Rock Point to Leone Bay is formed partly of rocks falling perpendicularly into the sea, and partly of rocks of lava, which extend some distance to seaward and on which the sea breaks.

Leading lights.—Leading lights have been established on Steps Point, the south extreme of this island.

The front light, exhibited from a white tower, 7 feet high, is a fixed white light, elevated 66 feet.

The rear light, exhibited from a white tower, 24 feet high, is a fixed white light, elevated 75 feet.

These lights in line, bearing 110°, lead about 1 mile southward of West Cape. They are obscured northward of 245°.

Leone Bay is on the southwest side of Tutuila. The bay is open to the south, and a wind from that direction would make it dangerous. During the months when the trades blow steadily it is smooth and safe. There is considerable level country about this place, and it is the most productive portion of the island, abounding in coconut and bread-fruit trees.

A vessel may stand in boldly clear of the shore reefs, which extend from 200 to 800 yards from the coast and are well marked by the surf which breaks upon them continually. The best anchorage is in from 20 to 16 fathoms, midway between Rock Point and the opposite shore.

The church, in line with a lone tree in rear of it 57°, is a good line of approach.

Vailoa, the principal place in Tutuila Island, is situated in the eastern part of Leone Bay, and may be easily recognized by a church built of stone, having a conspicuous white spire, situated close to the beach, about the center of the village. Landing is effected by a passage through the reef opposite the church; it is, however, only available at high water. There are rocks in the passage dangerous to boats when there is any swell.

West Cape, the west extreme of Tutuila is a mass of high, steep, rocks fronted by some rocky islets. In the bay to the southeastward are several villages.

Reef.—A reef, awash, is situated in a position from which this cape bears 90°, distant 3¼ miles.

Bank.—Rocky Point lies 122° from West Cape. A bank with 6 to 7 fathoms water over it has been reported 1 to 1½ miles 211° from the point.

North coast.—**Hubner Bay,** situated immediately northward of West Cape, affords good anchorage in 17 fathoms, off Poloa village, with the wind from south-southeast, through east, to east-northeast; but vessels should be prepared to leave at short notice, as it is reported that when the wind shifts to the westward a dangerous sea soon sets in.

Asu Bay or Massacre Creek, just westward of Fungasar Harbor, is small and surrounded by high mountains.

Fungasar Harbor, on the north side of the island, affords good anchorage. The inner part of the harbor is narrowed by reefs and rocks extending from the shore. A rocky point in the inner part of the harbor separates two villages; that on the east is Fungasar, shut in between the mountains, and the other is in a valley through which a river flows into the harbor. Vessels anchor between the east and west points of the harbor, rather nearer the former, in 14 fathoms.

The coast from Fungasar Harbor trends east-northeastward with two points, Southworth and Nelson, off the latter of which is a small reef.

Vatia Island (lat. 14° 16′ S., long. 170° 42′ W.), situated off the north coast of Tutuila, is high and rocky. Near this island is a dangerous ridge of rocks, which are high, indented, and steep, named Cocks Comb Point.

To the southward of Vatia Island is a small bay, which has not been examined.

Afono Bay is said to be a good harobr, with anchorage in 14 fathoms, coral. There is a church at the head of the bay.

Massefau Bay lies in a northeast and southwest direction. On the northwest it is sheltered by Bartlett Island, situated off the west point of the bay, to which it is joined by a reef. A rock, above water, lies close to But Point, the eastern point of the bay. The inner part is fringed by a coral reef, which narrows the anchorage and only leaves a small-boat channel to the beach.

Aur Bay, 1½ miles eastward of Massefau Bay, is said to be easy of access; it is of small extent, and but little is known of its value as an anchorage.

Cape Matutula, the northeast point of Tutuila, consists of high rocks, and projects some distance to seaward.

Red Point, the southeast extreme of the island, is not very conspicuous.

Upolu Island, 36 miles northwest by west from Tutuila, is about 40 miles in length in an east and west direction, and has an average breadth of 8 miles. This island appears richer and more fertile than the rest of the group, and rises in Mount Tofua to a height of 3,200 feet. The shores are fringed with coral reef, which in places is intersected by channels, forming convenient harbors.

A bank, having upon it a depth of 15 fathoms, reported by the *Hertha,* 1877, is situated about 10 miles 48° of Fanuatapu Island, off the east coast.

North coast—Caution.—Do not approach the northern coast of Upolu Island westward of Apia within 5 miles, as sunken dangers are reported to extend nearly that distance offshore.

Tapanga Point is the southeast extremity of Upolu Island. From this point a reef curves northward around the small islands Fanuatapu and Namua. Samusu Point, 3½ miles 358° of Tapanga Point, is steep and falls abruptly to the sea. Tiavea Bay, farther to the northwest, is small, with a rocky shore, and narrowed by coral reefs extending some distance from it. Uafato is another small bay; the coast westward to Fangaloa Bay is abrupt and steep.

Fangaloa Bay, upon the northeast coast, is 2½ miles in length northeast and southwest, 1 mile wide between the entrance points, midway between which the depth is 38 fathoms, decreasing gradually to 6 fathoms at the head of the bay.

Approaching Fangaloa from the northward Fao Peak can not be mistaken, and soon after sighting this peak a cataract, 620 feet above the sea, with a fall of 350 feet, will be seen at the back of Lona Village, between the bearings 212° and 144° from a distance of 8 to 10 miles. Approaching from the eastward, a clearly defined and prominent notch on the southern side of Fao Peak distinctly marks the entrance to the bay.

When Malata Peak bears 238°, stand in on that bearing and anchor southward of Salimu Point, in about 15 fathoms.

The western shore of the bay has a fringing reef, with deep water close-to, while the eastern shore line is ragged and broken. Each village has its boat passage through the reef.

Water can be obtained by boats at high tide from the stream at Lona Village. Fruits, taro, yams, and fowls can be obtained.

Tide.—The mean rise of the tide is 3 feet.

Winds.—The southeast trade wind, prevailing from April to October, draws into the bay as a northeast wind; the westerly winds are generally felt at the anchorage as coming from west-southwest to south-southwest.

Mohican Shoal, having 2¾ fathoms over it, lies 400 yards 335° from Lona Village, south side of the bay.

A bank of from 8 to 10 fathoms is situated in the approach to Fangaloa Bay from 2½ to 3 miles 49° of the east point of the entrance.

Coast.—**Sauano** is a village situated in a small bay next westward of Fangaloa Bay, where small craft can anchor, sheltered from easterly winds.

Falifa Harbor.—The coral reef extends about 1,800 yards eastward of the Sandy Point, which forms the northwest point of Falifa Harbor, about 600 to 800 yards southeastward of the dry patch on it, are patches of 2½ to 3 fathoms. Falifa affords good anchorage for small craft in from 6 to 11 fathoms.

Lufi Lufi village.—Northeast of Lufi Lufi village, and immediately eastward of Saluafata Shoal, there is a break in the coast reef, through which the British corvette *Danae* entered and was moored head and stern. On account of the shoals and the small size of the anchorage it should not be entered without previous examination from a boat; the holding ground is bad.

Saluafata Shoal, nearly connected with the coast reef, is a mass of coral heads, the shoalest of which is reported to have 1½ fathoms water. It breaks in a northeasterly swell. A bank on which a cast of 7 fathoms was obtained in 1880 is charted westward of the shoal and from 1,200 to 1,400 yards 342° from the western sand cay in Saluafata Harbor.

A patch of small extent, with a depth of 7 to 10 fathoms on it and 16 to 17 fathoms on each side, lies westward of Saulafata Shoal, with Ariadne Point beacon bearing 184°, distant 1,100 yards, and Utumanu 275°.

Saluafata Harbor, situated in a bay 9 miles east of Apia, is the best in Upolu Island. It is about ½ mile square, and protected from the swell by coral reefs through which the channel is about 400 yards wide. The northerly swell, which makes vessels roll considerably in Apia in the rainy season, has little effect on vessels anchored in Saluafata. The western side of the bay is encumbered by a reef 600 to 1,400 yards from the shore, upon which are two sand cays, and having a boat passage inshore of and between them. These sand cays frequently shift their positions. The entrance may be recognized by the two sand cays, and possibly by Albatross Island.

Albatross Island may be known by its black rocky base, and palm trees, which are about 70 feet high; it does not, however, show well against the dark background. The beacon on Ariadne Point within it is a good mark.

A native pilot can be obtained.

Directions—Leading marks.—Ariadne Point in line with the summit of the hill immediately behind it, bearing 178° leads into the harbor westward of Saluafata Shoal and the patches west of it.

A pyramidal beacon, having a triangular shaped head and painted white, stands upon Ariadne Point, 49 feet above the sea. It shows well against the wooded hills behind it, and serves as a mark for recognizing the harbor.

As this mark leads rather close to the point of the western harbor reef, and the current sets to the westward along the coast, it is advisable to keep the beacon just open westward of the summit of the hill, when passing it.

On the middle hill of the three on the east side of the harbor at a point two-thirds of the distance up the hill, a triangular white beacon has been erected, which bears in line with the beacon on Ariadne Point 178° and gives a good line of approach to the entrance from the westward; it apparently leads over the Danae Bank.

Caution.—The plan of Saluafata Harbor by the officers of the Imperial German Navy not being completely sounded, should be used with caution, especially when rounding the reefs or Saluafata Shoal.

Anchorage in 6 to 7 fathoms, fine sand, will be obtained about 400 yards 167° east of Casino Sand Cay; the western part of the harbor is preferable as being the most sheltered.

Supplies.—Fish, fowls, and eggs can be obtained in small quantities; oranges and coconuts are abundant. Cattle may be procured from a plantation, about 5 miles distant from the coast and, if it be expedient to keep them alive, good pasturage will be found upon the shores of the bay.

Water may be obtained from a stream situated in the southwest part of the harbor.

Landing.—The best landing is at Fusi village, in the south part of the bay, through a small opening in the fringing reef 40 feet wide.

Nautilus Bank, upon which there is a depth of 9 fathoms, lies with Mount Apia bearing 265°; and Albatross Island (in Saluafata Harbor) bearing 161°. It is probably the Danae Bank previously mentioned.

Vailele and Fangalii Bays are two small reef harbors situated, respectively, 2¾ miles and 1½ miles eastward of Apia.

A reef ½ mile in length, partly dry at low water, divides Vailele Bay into two parts. In the western portion is the settlement of Lotonga.

A shoal, about 400 yards in extent, with a least depth of 1½ fathoms, on which the sea breaks with heavy swell, lies in the fairway of the western entrance.

The anchorage is off the settlement, in 6 to 7 fathoms. The house within the settlement, bearing 239°, leads in the fairway between the long reef and the shoal in not less than 10 fathoms.

Between the shoal and the reef extending from the western shore, the edge of which is always visible, there is a channel with depths of 10 to 16 fathoms, but it is not recommended.

Dangers in the approach to Apia Harbor have been reported by various trading vessels in the following positions, as stated to the pilot at Apia:

A bank, having from 5 to 9 fathoms least water over it, 3 to 4 miles 54° from the northeast point of Apia Harbor Reef.

A bank, having 7 fathoms water upon it, is situated about 2½ miles from the shore on a 17° bearing from Mount Apia.

A bank, having upon it 9 fathoms of water, is also situated off Apia Harbor, at a distance of from 2 to 3 miles from the shore. From it Matautu Point bears 223°; Vailele Point, 169°.

Westward of Apia Harbor there are several rocky patches lying beyond the main reef.

Niss Reef, with 2½ fathoms, is charted 3¾ miles 4° from Falula Point; this position is, however, considered doubtful. It was not found in this position in 1890, but shoal water was discovered about 1½ miles 144° of it.

Caution.—As several patches are charted between it and the shore reefs, vessels should pass northward of Niss Reef, or at about 5 miles from the coast.

Fangalii Bay is an inlet in the coral reef about ½ mile in extent, open to the northward. It has depths of 5 to 10 fathoms. There is a church and boathouse at its head.

Apia Harbor, on the north side of Upolu, is a reef harbor about 9 miles westward of Saluafata.

Deep approach, available for largest vessels at all times of tide.

Anchorage, exposed to the northward, and unsafe during the hurricane months, in depths of from 5 to 10 fathoms, indifferent holding ground, over a space ½ mile long and ¼ mile broad.

Pilots.—A good pilot can be obtained, who boards vessels 3 or 4 miles outside the harbor. It is advisable to employ him to point out where the moorings are placed, and also the best holding ground, for the bottom is a layer of mud over coral, and in some places this layer is too thin to form good anchorage.

There is a pilot station with a flagstaff at the extremity of Matautu Point; the flagstaff is a good distinguishing mark, approaching from the eastward, and can be seen from a distance of 7 or 8 miles.

Leading marks and lights.—Two leading lights are exhibited from white lighthouses on the southern shore of Apia harbor.

The front light is a fixed red light, elevated 50 feet above the sea, and should be visible 3 miles. Above the light is a triangular white topmark. It is situated between the Bishop's Palace and the beach. The palace is the first on the right of the new cathedral.

The rear light is a fixed red light, elevated about 213 feet above the sea, with a triangular white topmark above the light. It is shown from a building 34 feet high and should be visible 9 miles. It bears 193° distant about 1,159 yards from the front lighthouse.

An iron framework tower has been placed on the edge of the eastern reef in the harbor 283° from the flagstaff on Matautu Point; a green light, visible 2 miles, is shown from this beacon.

A pyramid-shaped beacon stands at the harbor entrance on the edge of the western reef.

A fixed green light is exhibited from a beacon on East Reef.

Buoys.—A red conical buoy is established at ¼ mile southward of East Reef light-beacon.

There are three mooring buoys, painted red, for the mail steamer, station cruiser, and one in shoaler water. It is usual to moor by the stern in Apia Harbor. Vessels discharge cargo at the wharf eastward of Hotel Tivoli.

It is not a safe anchorage during the hurricane months, and it is advisable to put to sea at once upon indications of a hurricane. The remains of one of the warships wrecked in the hurricane in March, 1889, is still on the reef on which it was cast, off the settlement.

Directions.—Those entering for the first time should take a pilot, otherwise they are likely to foul the moorings.

The lighthouses, or the lights at night, in line bearing 193° lead into Apia harbor, between the reefs at the entrance, and to the mail steamers buoy, then anchor as directed.

If staying for a length of time in Apia, it is advisable to secure with three anchors in the southeast part of the harbor.

Making Apia at night, the lower red light comes in sight before the upper one, and the latter is at times dimmed by haze.

Apia is the capital and the most important place in the Samoa group, as besides the usual supplies of provisions, small repairs to vessels can be effected there.

Supplies.—Beef, pork, poultry, and the usual tropical fruit can generally be obtained, but are not plentiful.

Water can be obtained from the river Vaisigano, which empties itself at the southeast corner of the bay. Boats should ascend as far as possible about low water, and load just before the tide begins to flow; but even then it is not very good, and should only be used for washing purposes.

Coal.—About 650 tons of coal is kept in stock and 1,300 tons imported annually, and is delivered alongside in punts. There is no wharf. and coaling is impeded at times by the heavy sea.

Tides.—It is high water, full and change, at 6h. 30m.; springs rise 4¼ feet.

The Resident's house stands on Mutinuu Peninsula.

An observatory station has been erected on the north point of this peninsula. Position: Latitude 13° 48′ 26″ S., longitude 171° 45′ 54″ W.

Upolu, west end.—**Manono Island,** 400 feet high, lies midway between the west point of Upolu and Apolima Island, and is about 3 miles in circumference. It is well cultivated and thickly populated.

The reef on which it stands is connected with Upolu, and extends for nearly 1 mile to the westward; at a short distance inside the edge is Nulopa Islet.

Discolored water has been observed in and off the bight between Manono Island and Salafuata Point.

South coast—Falilati.—The reef which fronts the north and west coasts of Upolu comes to an abrupt termination at Faliati, and it is reported to extend further seaward than is charted.

There is the entrance to a boat channel inside the reef, which is used by natives from Lafanga when going to the westward. Samatua is a large village near the southwest point of Upolu. Lafanga, eastward of Falilati, is situated at the head of a rather deep bay, where there is anchorage for boats, formed by the fringing reef which commences again here and continues to Safatu.

Safatu Harbor.—The entrance to this harbor is difficult to make out until close-to, there being no good landmarks.

The church at the head of the harbor bearing 11° leads between the western reef and the detached reefs which lie in the fairway eastward of it; these are marked by breakers where there is a small channel.

The bottom is everywhere fine sand, and the harbor is reported to be a safe one, the gales being generally from the northward. Notwithstanding the narrowness of the entrance, a heavy swell sets into the harbor, especially at high water. It is advisable to moor as there is little swinging room..

It is high water full and change at 7h. 30m., springs rise 3¼ feet.

Land and sea breezes prevail, the former at night and the latter by day. The village at the head of the harbor is named Lukofana. The church, a low yellow building, is not very conspicuous; a stone church was building (1902) at Furi on East Point. The eastern bay affords more shelter than the western.

Falealili Harbor, upon the south coast of Upolu, is sheltered from northerly winds only, and is some 600 yards in extent, with depths of 13 to 16 fathoms. The outlying islet Satalo, known to the natives as Uuusafee, is useful for distinguishing the entrance.

Two patches with 1 fathom water lie about 200 yards off the northwest extreme of Satalo reef; they sometimes break. A patch lies close off the point of the northern or shore reef.

Satalo Islet is low and covered with trees and palms, and has sandy beaches on the south and southwest sides.

This harbor is too small and deep to allow sufficient chain to be veered in a heavy gale; on the other hand, it is not so much exposed to the ocean swell as the other harbors in the island.

In the eastern passage a rock with about 4 feet water on it was observed; it would not be advisable to enter this way.

The tomb, if conspicuous, bearing about 77°, would lead to the fairway of the western entrance. The German warship *Cormoran* anchored with the tomb bearing 80° in 16 fathoms.

Malaemalu village is the most important on the south coast, and has a population of from 3,500 to 4,000 inhabitants. Provisions and stores can be obtained in limited quantities.

Upolu—Southeast extreme.—Nuutele and **Nuulua Islands,** situated near the southeast point of Upolu, are respectively 200 feet and 120 feet high, and steep; the former, however, has a low sandy beach on its north side.

A rock with 6 feet water lies between Nuutele and off Tapanga Point. Large vessels should avoid this passage.

Lepa, westward of Tapanga Point, is marked by a long, low, white church with bright red roof and no tower.

Apolima Island and Strait.—Apolima Island is a small volcanic island, 472 feet in height, lying in the channel between Upolu and Savaii, about 1½ miles 313° of Manono Island. It is about 2½ miles in circumference and steep-to around, no bottom being obtained at 20 fathoms at 50 yards from its shore.

Landing can only be effected at one bight a few yards wide.

There is a good stream of water on the island.

Apolima Strait, about 3½ miles wide, separates Upolu Island from Savaii. It is clear and easy for a steamer but might be dangerous for sailing vessels, unless being sure of a favorable breeze, as those which have passed through the channel from south to north state that there is a strong current setting to the eastward upon Apolima, and after that island is passed a strong countercurrent sets to the westward toward Savaii.

When some distance to the northeastward the hill over Tofua, on the southeast extreme of Savaii, might be mistaken for Apolima and the latter for Manono, which, being lower, does not appear until much closer.

There is a channel, about ½ mile wide, between Apolima Island and the reef extending westward of Manono. It was reported (1909) that a rock exists in mid-channel which would render it unsafe; there is no necessity for using it.

The hill situated at the southeast end is 550 feet in height and forms a good mark for making Apolima Strait. It begins to show above the horizon about the same time as Apolima Island and appears as an island, as it is only connected to the other mountains by a low ridge.

Shoal.—A shoal of 8 fathoms has been reported in this strait in a position about midway between Apolima Island and Savaii at approximately 2 miles westward of the former.

Savaii Island is the westernmost and largest of the Samoa Group. It is about 40 miles long and 20 miles broad and differs from the others in appearance, the shores being low and the ascent to the center gradual, except where the cones of a few inactive craters are seen. In the middle of the island there is a peak 5,400 feet in height, which is constantly enveloped in clouds.

The coast between the southeast extreme of Savaii Island and the reef extending off Paluale village is apparently free from danger beyond a distance of 200 yards from the shore of Savaii.

In 1905 an active volcano, named Mata vanu, was formed near the center of the island.

Satupaitea—Rock.—A rock of 1¼ fathoms is situated on the eastern part of the shoal southward of Satupaitea, and a rock of 2¼ fathoms near the western extremity.

South coast—Paluale anchorage.—Those wishing to communicate with Paluale, on the south coast of Savaii, will find fair anchorage in northeast winds near the eastern side of the bay, off the reef fronting the settlement, with the 550-foot hill at the southeast end of Savaii Island bearing 99°, at a distance of about 800 yards from the reef, in 24 fathoms, sand.

The imperial German vessel *Carola* was anchored in 20 fathoms water, 650 yards 32° from the east point of Satupaitea, the bottom coarse, yellow sand and shells. If intending to anchor on this side of Paluale Bay, be careful to avoid the shoal with from 3½ to 8 fathoms, on which the sea often breaks, lying to the southward of Satupaitea Point. The *Carola* passed between this shoal and the point and found not less than 19 fathoms up to the before-mentioned anchorage. The shoal was found to extend in an east-northeast and west-southwest direction and is separated from the shore reef by a narrow channel. The shore reef is about 200 yards wide and steep-to.

With a good sun for seeing the reefs, and by mooring head and stern, anchorage can be obtained in the bight in the reef off Paluale at the distance of 1 mile from its eastern end. There are three sunken rocks in this bight and a dangerous shoal lies at its entrance. The difficulty of entering or leaving this anchorage in thick weather is obvious, and it can not be recommended in consequence.

Salealua.—This bay is distinguished by the fact that in it will be seen the first fringing coral reef from the south point of the island. The anchorage is in the middle of the bay in 18 or 19 fathoms. There are reported to be rocks in the southern part of the bay, but nothing was seen of them by the German naval vessel *Cormoran*.

There is protection in this bay as long as the wind does not come to the southward of southeast by east. The holding ground is good.

Coast.—The south side of the island is rocky, and as there are no fringing reefs, a heavy surf beats directly upon it, so that there are but few places where landing can be effected.

Falelima village, near the northwest end of Savaii Island, has a rocky coast line projecting, between the rocks of which landing can be effected in favorable weather at high water; the village may be recognized by a white house in its center and another at its southern end. There is no anchorage, and no bottom could be obtained within ½ mile of the shore with 100 fathoms of line.

North coast of Savaii.—Felialupo, the northwest extremity of Savaii Island, terminates in a low rocky spit. A white church near this point is a conspicuous landmark.

Sataua, 4 miles eastward of Felialupo, will be recognized by the first European houses seen; they are eastward of the village of Papa, which lies among the coconut trees.

Anchorage may be had in the middle of the bay in from 15 to 20 fathoms, where there is good shelter from the trade winds.

Asaua Harbor has a depth at the entrance of 9 feet only at high water, and is useless to any but very small craft. A good landmark for this bay is Mount Mua, a truncated cone, which on a 161° bearing leads into the bay.

Anchorage may be had about 600 yards north of the east corner of the entrance reef.

Landmark.—Amvalea church, situated in the southwestern part of this harbor, with red roof and white spire, is conspicuous when approaching from the eastward.

Safune Road, on the north coast, and 23 miles eastward of Felialupo, affords anchorage in 13 fathoms during southeast winds, but there is usually much swell. There are two boat passages to the shore through the reef; the western is the better, although farthest from the settlement. If there is much swell, the eastern passage is practicable at high water only.

Mataatu Harbor is a mere indentation of the coast about 3 miles eastward of Safune. It is surrounded by coconut groves, behind which the houses are built.

The anchorage is in from 9 to 14 fathoms, sandy bottom, between the reefs, and is much exposed at all seasons; but between November and April, when north and northwesterly winds prevail, it is dangerous and should not be visited. There is good shelter in this anchorage during the trade-wind season.

The coast line has been altered in the neighborhood of Mataatu by the flow of lava from an active volcano in the vicinity.

A new volcano has formed approximately 5½ miles 165° from Mataatu church. The volcano is 1,875 feet high.

When approaching Mataatu Harbor from the westward do not approach the coast reef nearer than ¼ mile. A depth of 6 fathoms has been obtained 300 yards distant from the coast reef and 1 mile westward of Mataatu, and there appeared to be shoaler water inside that position.

A rock of small extent, with a depth of 2 fathoms, lies 250 yards from the edge of the reef, with the church at Mataatu bearing about 129°, distant 1,600 yards.

A conspicuous white house, with corrugated iron roof, is situated about ½ mile northeastward of the church.

Juno Rock, with 14 feet over it, lies 300 yards 330° from the reef on the northeast side of the entrance. There is 5 fathoms of water in rounding this reef at the distance of 400 yards; it should be given a wide berth.

A small bank of 7 fathoms, lies with the church bearing 167°, distant about 2 miles. Another church has been built close to and to the east of the church marked on the chart.

Bank.—A bank of 7 fathoms is situated 1 mile north-northwestward of the church.

Coast.—The eastern coast of Savaii is fronted by a barrier reef, extending between 1 and 1½ miles from the shore, through which there are several passages for boats.

The reported good harbor at the east extreme end of Savaii is only good for coasters and small vessels. There is no room for vessels over 150 feet long, except moored head and stern.

The boat passage opposite Sapapale is reported to be indifferent even for boats. The Suulu Passage, situated eastward of Iva Point, is the best in the neighborhood, and is used by small coasters of 30 or 40 tons. The entrance should, however, be approached with caution, as there are several patches lying outside the barrier reef. On one of these 5 fathoms has been obtained, with the entrance bearing 279°, distant ½ mile.

Salelolonga.—The harbor is not difficult of access and anchorage in 14 fathoms.

Mount Tafua, at the southeast extreme of the island, is a guide for the harbor. The harbor affords good shelter in fair weather, but a stay is inadvisable with strong southeast trades.

CHAPTER VII.

FIJI ISLANDS AND ADJACENT WATERS—SUBDIVISIONS—FORMATION—RIVERS—GOVERNMENT—POPULATION—LANGUAGE—PRODUCTS—SUPPLIES—WINDS AND WEATHER—TIDES—CURRENTS.

The Fiji Islands—General remarks.—The Fiji Islands may be subdivided into three distinct parts, consisting as follows:

Viti Levu (meaning great Viti or Fiji, the largest of the Fiji Islands) and its neighboring islands, in one of which, Ovalau, is situated the town of Levuka, for many years considered the capital of the group, although, from position and other causes, Suva, on the south side of Viti Levu, is now the seat of government.

The Weather or Eastern Group, locally known as Lau, comprising Lakemba and the surrounding islands, of which the capital Lomaloma is situated on the eastern side of Vanua Mbalavu.

Vanua Levu (Great Land), the second in size of the Fiji Islands, has many well-protected anchorages on the north and west coast, approached through passages in the barrier reefs, and an extensive bay on the south coast which is easy of access from the ocean, and which comprises one of the best harbors in Fiji.

The formation of the various islands is elevated coraline limestone and volcanic, and some are very mountainous, the whole as a rule being rich and fertile. The largest and highest island, Viti Levu, has several peaks rising to a height of 4,000 and one about 5,000 feet above the sea.

The majority of reefs in Fiji are steep-to on the south and east sides, and seldom admit of the possibility of bringing up with an anchor clear of the breakers.

Rivers.—The two principal rivers in the Fiji Islands are the Rewa and Singatoka, draining the mountainous country in the interior of Viti Levu; only boats can enter the Singatoka, but the Rewa, which is by far the larger in extent and volume, is navigable during the rainy season (December to April) for craft of 6 feet draft for a distance of 30 miles from its mouth.

Supplies such as are necessary for the repairs or refit of small vessels can be obtained in certain ports of the group, details concerning which will be found in the course of the more detailed descriptions.

Caution.—Some of the fish are poisonous, so that great caution should be observed by strangers in partaking of them.

Winds and weather.—In the Fiji Group the wind blows strongest and with most persistence from southeast and southeast by east. Southeasterly winds prevail with sufficient regularity, away from the influence of the large islands, to entitle them to be called "Trade winds."

Around the islands Viti Levu, Vanua Levu, and Taviuni, the direction of the wind is much altered by the trend of the coast, the height of the mountains, and the effect of the land and sea breezes, which are, in many parts of the coast, clearly apparent.

The southeasterly wind is strongest in the months of August, September, and October, when it rises occasionally to the force of a moderate gale; and is most feeble in December, January, February, and March. After a short period of calms, or light winds with westing in them, the "trade" sometimes returns in a smart squall from south-southwest or south, and quickly shifting. A sudden rise of one-tenth of an inch in the barometer, with lightning to the southward, indicates the approach of a change of this description.

On the south coast of Viti Levu, at night, a light breeze comes off the land; the trade wind here blows from southeast by east, and prevails between 5 a. m. and 5 p. m. Among the islands off the west and northwest coasts of Viti Levu, the southeast wind, interrupted by the lofty hills, finds its way sometimes as a northeast, and sometimes as a southerly wind. Violent gusts from off the land are occasionally experienced in this neighborhood at night.

The air of the west coast of Viti Levu is drier and more exhilarating than in other parts of the group; in this part the wind by day is from the northwestward during the trade-wind season, and a southeast wind generally comes off the land at night.

The mean height of the barometer, in inches, at 9 a. m., at Suva (reduced to 32° F. and mean sea level), for a period of 15 years (1885–1910), during the hurricane months, December to March, is as follows: December, 29.886; January, 29.860; February, 29.863; and March, 29.879.

The diurnal movement of the barometer is well marked, and is about 0.06 inch, the maxima occurring at about 10 a. m. and 10 p. m., and the minima at about 4 a. m. and 4 p. m.

Hurricanes.—Between the years 1848 and 1910 34 cyclones have been recorded which have affected the whole or a portion of the group, those of extreme violence occurring at intervals of some years. The general tendency is for these storms to travel to the southeastward, but instances occur of some traveling to the southwestward, and of others, during a part of their course within the group, to the northwestward or north-northwestward.

The lowest recorded height of barometer was 27.57 inches, at Buen Bay, in March, 1886.

In March, 1910, an exceptionally severe hurricane was experienced. During the hot months, namely, December, January, February, and March, cyclones occur. They appear generally to approach from the northeastward; to recurve around the western portion of the group, and thence to travel to the southeastward, the chief force of the storm being felt at the Yasawas, Nandi, and Kandavu, while Levuka feels merely a strong northerly gale and Lau is not influenced by the gyration. Exceptions to the usual course were the cyclones of 1866 and 1871, these storms having been felt equally all over the group, throughout which they effected much damage. These storms occur on an average once a year.

At intervals of a few years the center of a cyclone passes over the west coast of Viti Levu, accompanied by a wave sometimes as much as 10 feet above the ordinary sea level, which inundates the coast. Of this nature were the storms of 1869, 1879, and 1886, when several lives were lost, much property destroyed, and the country completely stripped of foliage.

The British naval vessel *Emerald* passed through the eastern edge of a cyclone, being nearest to the center early in the morning of December 11, 1879, 120 miles south of Rotumah. The wind was felt at the force of a severe gale from the northwestward; the lowest barometer recorded was 29.43 inches.

The schooner *Mona* was anchored at Totoya with both cables veered to the clinch and felt the cyclone very severely from 8 p. m., December 11, 1879, when the wind was northeast, to daylight on the 12th, when it was from the westward. A sudden and very violent shift took place at 1.30 a. m. on the 12th from northeast to northwest.

In the eastern portion of the group nothing but a strong breeze was experienced. There is no reliable evidence of much damage ever having been effected in Lau or in Taviuni by cyclones, the eastern edge of the storm only being felt, and that rarely.

The climate is adapted to all tropical plants, and to many of the temperate zone, in the mountainous portions of the islands. It is different, however, on the opposite sides of the islands. The southern sides, exposed to the southeast trade winds, and refreshed by showers, exhibit luxuriant vegetation. The northern sides, on the contrary, have a burnt and barren appearance, from want of moisture, although the difference in temperature is not great.

In February and March, when the greatest amount of rain falls, the climate, with its humid atmosphere, is considered oppressive and enervating to European constitutions; the fall at Suva was 169.6 inches in 1906; the greatest was 26.5 on August 8; this is considerably in excess of the records up to 1904; in 1912 the rainfall was 115 inches; the greatest on one day being 10 inches. Low fevers are unknown; the disease feared by Europeans is dysentery.

Tides and tidal streams.—The rise and fall of the tide throughout the Fiji Islands varies from 3 to 6 feet at spring tides. The tidal streams are by no means regular in direction or force, being apparently in the latter respect greatly influenced by the wind.

As a rule the flood tide has "southing" in its direction between the reefs and islands, and the ebb tide "northing" the flood being stronger than the ebb.

In Nanuku Passage and Somo Somo Strait, at the northeastern part of the group, the general direction of the flood stream is to the southward, ebb to the northward.

On the south coast of Viti Levu, the flood sets to the southeastward, ebb to the northwestward.

Among the Lau or Eastern Group, the flood sets to the south-southeastward, ebb to the northwestward, but without regularity.

Between the islands Oneata and Mothe, the flood stream has been found making to the southward, ebb to the northward, the proximity of the reefs deflecting these directions to northeast and southwest, respectively.

Near Yendua Island, on the west coast of Vanua Levu, the ebb stream has been observed to set to the southwest. The strongest tidal stream hitherto found in the group is in Somo Somo Strait, where it runs 3 knots an hour after the full and change of the moon. In some lagoon passages the tidal stream runs as much as 2 knots an hour during springs; and notwithstanding that the entrances are chiefly on the northwest side of the islands, the flood appears to be as swift as the ebb.

Currents.—In Kandavu Channel, with strong east and southeast winds, the current sets at the rate of about 1 mile an hour to the westward; but after westerly winds there is a decided easterly set.

While surveying among the Lau or Eastern Group, in the fine weather season (April to November), the British naval vessel *Alacrity* experienced little or no current, except in the lagoon passages, where it was distinctly tidal, and near the reefs, where it did not appear either regular or to exceed the rate of ½ knot an hour. During the months December to April, an easterly set has been experienced.

Doubtless, in strong trade wins, there is a slight surface drift, but it ceases when the wind moderates. On several occasions during the survey a slight easterly set was perceptible, and the facility with which badly found boats voyage from the leeward islands to the windward shows not only that there can be no consistent westerly set, but that the prevailing movement must be in the opposite direction. Oil casks shipwrecked at Vanua Vatu have been recovered at Mothe; and there are other instances known to those who have been a long time trading in the group, proving the existence at times of an easterly current.

A bottle with hydrographic notice addressed to the Admiralty, Berlin, was thrown overboard from the German naval vessel *Condor* in latitude 15° 35′ S., longitude 179° 18′ W. on November 30, 1906, and was found on Yathata Island on December 10, 1906. As it was picked up on the beach near the town it was considered probable that it was discovered on the day it drifted ashore. If so, the bottle traveled 103 miles southwestward in 10 days.

It is stated that several vessels have been swept past Vatoa by the current and lost on Vuata Vatoa Reef to the southward.

Temperature.—During the rainy season, December to April, the thermometer in the shade has been found to range from 66° to 88°, the greatest difference between the wet and dry bulbs being 10°. At this time the temperature of the surface sea water varied from 77° to 88°, with an average of 81° F.

From meteorological observations extending over a period of many years, registered in different parts of Fiji, the warmest month is shown to be that of February, when the mean temperature in the shade amounted to 84° F.; the coolest month that of July, with a mean temperature of 77°, and the average temperature throughout the year 79°.

In the fine-weather months, April to November, the average daily temperature in the shade is about 78°, and the southeast trade wind at that time prevailing the air appears cooler than is actually the case.

The barometer during the fine months, April to November, stands at about 30.10, seldom moving more than three-tenths of an inch, and showing highest for east-southeastward winds, and lowest for those from the northwestward.

At the approach of and during a hurricane, however, the barometer has been known to fall 2 inches.

Rainfall.—Rain is felt heaviest on the southeast coast of Viti Levu, but there is a considerable fall in Ovalau and on the south and east sides of Vanua Levu. In 1876 the total rainfall for the year at Levuka was 108.05 inches; rain fell on 162 days, and the greatest fall for one day was 5.6 inches.

At Mbua, in Vanua Levu, the mean total rainfall for eight years was 106.19 inches per year.

At Taviuni the total rainfall for 1879 was 101.04 inches. On the River Rewa, in the same year, it was 116.04 inches. In this district rain fell on 240 days in the year, and the greatest fall in one day was 4.7 inches.

Hail is occasionally experienced. On April 29, 1878, at Mango Island, hailstones fell which proved to be between 1 and 2 inches in circumference. The wind was strong from southeastward and there was a violent thunderstorm. Bridges were washed away and roads destroyed.

The health regulations are necessarily stringent on account of the facility with which the Fijians contract European diseases, as instanced by the epidemic of measles in 1875.

The sale of intoxicating liquors to natives is prohibited by law, under a heavy penalty.

The time of the Fiji Group has, to avoid inconvenience to the judicial courts and evasions of law, been declared by an enactment of the legislative council to be the mean time of Suva.

The same day of the week is kept as that in Australia.

Earthquake shocks are occasionally felt at Savu Savu, and are not unknown at sea in the neighborhood of the Fiji Group.

There are no signs of recent volcanic action in any of the islands, but the coasts of the eastern group are strewn with pumice, ejected by the volcanos to the southeastward.

Southern group.—Tuvana i tholo and Tuvana i ra, also formerly known as Simonov and Michaelov, are two densely wooded sand cays, surrounded by inaccessible reefs, which break heavily, and can always be seen during the day, but as the tops of the trees are only about 95 feet above the sea these islands should be given a wide berth if not sighted before nightfall. Tuvana i tholo bears from Tuvana i ra 255°, the distance between the centers of the reefs being 5½ miles.

These islands are each about ½ mile in diameter, and in all particulars are types of each other; they do not occupy the center of their respective reefs, which are circular, but are situated nearer their northern edges. Tuvana i tholo Reef extends ¾ mile and Tuvana i ra ½ mile to the southward of the respective islands. The edges of these reefs are 4½ miles apart, having a clear passage between them, well defined by breakers. A canoe might land at times on the north side of either island, but no huts nor any indications even of an occasional occupation were seen.

Vuata ono (signifying the offspring of Ono), also known as Bereghis Reef, is awash and always breaking. It is 2¾ miles long east and west and from 1 to 2 miles wide. Ono i lau Island Peak bears 55° distant 8 miles from the northeast elbow.

Ono i lau Islands.—The name Ono, signifying in Fiji six, aptly applies to a cluster of three volcanic and three coral islands, all thickly wooded, covering a space about 5 miles in length northeast and southwesst by about 4 miles wide. Only the three volcanic or larger isles are inhabited. They are the remains of an old crater about 3 miles in diameter, now split into three portions, with from 14 to 20 fathoms in the channels thus formed. At the northwestern part of the largest island is the peak of Onon i lau, 370 feet high.

From the islands the surrounding oval rim of the reef extends 1¾ miles southwestward, 2 miles northeastward, and only ¾ mile northwestward and southeastward. The southwestern elbow is marked by breakers only, but the other edges are denoted by islets covered with trees, which stand out upon the northeastern extreme of the oval reef belt, as also upon its north and south sides. The accessible part of the reef for canoes or whale boats may be looked for on its northwestern face, with the peak bearing 168°. Konaoe Island is known locally as Doi Island.

Anchorage, during southeast wind and fine weather, may be found on the northwest side of the reef encircling the islands, with Ono i lau Island Peak bearing 185° and Konaoe Island Peak 134°. In this position the Mana Islets, on the south side of the reef, will be about half their own breadth, open of the west side of Konaoe Island, and the depth will be 14 fathoms, rocky bottom.

Supplies of a few fowls and coconuts may be obtained at Ono i lau Island, and fresh water is to be had from springs.

Tides.—It is high water, full and change, at the Ono i lau Islands at 6h.; springs rise 6 feet, neaps 4½ feet.

Vatoa (lat. 19° 49′ S., long. 178° 13′ W.) lies at the southeast extreem of the group and 57 miles 30° from the peak of Ono i lau Island. It is a low, narrow strip of coral structure, densely wooded, 2 miles long by ½ mile wide, rising gradually at the northern part to an elevation of 209 feet. As, however, it has a reef extending 1 mile off its north and south sides, it may be considered as occupying a space equal to 4 miles by 1¾ miles.

A detached reef named Vuata Vatoa (Vatoa's child), measuring from north to south 2¾ miles and 2 miles east and west, with a tidal basin of deep water, lies about 3 miles 213° from the southwestern extremity of Vatoa Island.

The passage between Vatoa and Vuata Vatoa is about 2 miles in width, having 90 fathoms alongside the breakers and 246 fathoms in mid-channel, and might prove an acceptable resource to those coming unexpectedly upon Vatoa Island in hazy weather. The current sets to the northwestward upon the reef side of the passage and southeastward on the island side.

There is communication by a boat passage through the reef that surrounds Vatoa Island into an excellent boat harbor on its northwestern side, which may be found by bringing the northern extreme of the island to bear 145°.

Anchorage of a temporary nature in southeast winds may be found near the boat passage in the barrier reef of Vatoa in 13 fathoms, sand and shells, with the following bearings: Outer part of the Three Sisters rocks 230°, north point of Vatoa Island 145°. This latter bearing leads through the boat passage.

Water can be obtained from springs on the beach on the west side of Vatoa Island.

Tides.—It is high water, full and change, at Vatoa Island at 6h. 11m.; springs rise 4 feet.

Matuku Island summit, Ngilli gilli (lat. 19° 10′ S., long. 179° 45′ E.), is elevated 1,262 feet above the sea. The island trends north and south 4½ miles, with an average width varying from 1¼ to 3½ miles. It is wholly bound by fringing reef awash at low water and which projects off the northern and southeastern points of the island to the distance of 1 mile, though not more than ½ mile from the other parts of the island.

Upon the western side of the fringing reef, with Koro Levu, or the central peak, bearing 92°, is a passage about ⅛ mile wide, easily seen from the masthead, leading into Matuku.

For other passes see the plans.

Supplies of water, wood, vegetables, poultry, and pigs can be obtained.

Tides.—It is high water, full and change, at Matuku Harbor at 6h. 18m.; springs rise 5 feet, neaps 3 feet.

Totoya Island (lat. 18° 9′ S., long. 179° 52′ W.) lies 21 miles 44° from Matuku Island and is of circular form, with a diameter of about 6 miles. When viewed from its peaks this island presents the appearance of a crater filled from the ocean, of which the diameter is 3 miles and the depth of 30 fathoms of water. The summit of the ridge of peaks which surround it is 1,200 feet above the sea.

This island is partly surrounded by a barrier reef, the abrupt elbows of which range 2 miles off the southwest, northwest, and eastern projection of the island.

Herald Sound.—A ship entrance exists on the western side of the reef, which may be found by bringing Numbuni, or the southeasternmost peak, elevated 1,159 feet, to bear 103° when it appears in the gap of the intervening ridge of land. The sea breaking upon the horns of the reefs will indicate the fairway, after passing which Herald Sound, a spacious sound of smooth water, presents itself to the southward, occupying a space 2 miles long by 1 mile broad, well sheltered and with good holding ground in 25 fathoms. The shores of this roadstead are not adapted for watering or seining.

There is no ship passage from seaward into the extensive basin formed by the crater above mentioned, but the plan shows a passage named the Gullet, having 25 fathoms and only 100 yards wide, into it from the eastern end of Herald Sound, and in which the tidal streams run from 3 to 4 knots. In November, 1897, the steamer *Yaralla* passed through the Gullet, getting 25 fathoms water, and anchored in the crater.

Supplies of wood, vegetables, poultry, and pigs are obtainable.

Tides.—It is high water, full and change, at 6h. 37m.; springs rise 4 feet 4 inches.

Na Vatu Reef (Tova Reef) (lat. 18° 40′ S., long. 179° 32′ W.) is a circular coral reef which dries at half tide, and lies 23 miles 44° from Totoya. It is 3 miles in diameter, encircling a basin of water 16 fathoms deep, while 300 fathoms is the depth at a distance of ¼ mile northwest of and outside the reef. There are three boat passages through the northern elbow of the reef by means of which access can be gained to the smooth water within.

Tides.—It is high water, full and change, at Na Vatu Reef at 6h. 8m.; springs rise 4 feet.

Moala (lat. 18° 33′ S., long. 179° 57′ E.), of volcanic origin, on the southern side of the group, is about 7 miles long by 5 miles broad, the barrier reef projecting 3 miles off the south and northeast points of the island and 1.7 miles off its western point. The island is deeply indented on the eastern face, forming a bay 2 miles deep and ¾ mile wide, with depths of from 10 to 20 fathoms, the approaches being intricate for a large vessel.

The summit of Moala (Dilli Moala) at the western part of the island, is elevated 1,535 feet, and if kept on the bearings 277° or of 321° will lead to either of the two reef openings on the eastern face of the island, while Double Hill, which rises in the southern portion of the island, when brought to bear 80°, will likewise lead to a narrow channel through the reef on the southwestern coast.

Maloku village is situated about the center of the northwest side of the island.

This island abounds in coconuts, and there is a tolerable produce of roots, fruits, vegetables, poultry, pigs, and fish; but strangers should be cautious with regard to fish caught here or elsewhere, as some species are poisonous.

Herald Roadstead.—Large vessels may anchor in this easily accessible roadstead, off the northeastern projection of the island, which affords shelter from the prevailing southeast winds, the approach to which may be found by bringing the well-defined northeast extremity of the island bearing 167°, which, with a masthead lookout for detached coral patches, will lead to an anchorage in 20 fathoms upon a coral bottom. This anchorage will be reached as soon as the cluster of black rocks named Observatory Rocks stand out clear of the northern face of the island bearing 258°, taking care on approaching them to pass eastward of a 6-foot patch lying ¼ mile 38° from Observatory Rock.

Two coral patches, having upon them about 1½ fathoms of water, are reported as being situated on either side of the leading mark through the northern channel to Herald Roadstead.

From the northern of these patches Observatory Rock bears 182°, distant 1¼ miles; from the southern patch, Northeast Point bears 170° distant 1½ miles.

Tides.—At Observatory Rock, near the northeast point of Moala, it is high water, full and change, at 5h. 50m.; springs rise 5 feet.

Ngau Island (lat. 18° 03′ S., long. 179° 19′ E.) is volcanic, trends south-southeast and north-northwest, for 11¼ miles, by about 4 miles in width, and is fronted on the west by a barrier reef 16 miles in length, extending seaward 3½ miles. Three ship passages exist through the barrier reef on the northwest side of the island, leading into a sheltered roadstead of 20 fathoms. The best of these passages, the central one, is found by bringing the peak of the island, which is elevated 2,345 feet, to bear 94°; or Lion Peak, a lower hill, 114°; both lead near some 4-fathom patches. There are also six boat passages in the fringing reef upon the eastern side of Ngau Island.

Supplies of yams and pigs may be obtained, and also wood, but there is no facility for watering.

Tides.—It is high water, full and change, on the northwest side of Ngau Island at 6h. 7m.; springs rise 5 feet; neaps, 3¾ feet.

Mambulitha Reef lies 4½ miles 190° from the southern elbow of the boundary reef of Ngau Island. It is 1¼ miles long, in a north and south direction, and ½ mile broad, with no opening, and presenting a shallow basin of water of a pale green hue. The lead gives no warning of the proximity of this danger, and the sea generally breaks heavily upon it.

Nairai Island is volcanic and trends north and south for 4 miles by 1½ to 3 miles in breadth. It is surrounded by barrier reef which ranges 5 miles off the west and 4 miles off the north and south extremes of the island, a ship opening in the southwest barrier, named Nayatha, leading to a sheltered anchorage, may be picked up by steering in with Craig or Quoin Peak to line with Green Mound, bearing 55°, until Ndalithi Village is in line with the point southward of it, bearing 10°, when it should be steered for.

There is a good passage at Na-leve, southward of Nyatha, as charted, but, as at Ngau, a masthead lookout is necessary for coral patches.

Magnetic disturbance.—Nai Kobu, a rock 90 feet in height, situated ¾ mile southward of Nairai, is remarkable for its magnetic disturbance; on the summit the compass was deflected 87°.

Tides.—It is high water, full and change, at Nairai Island at 5h. 53m.; springs rise 4 feet 7 inches.

Thakau momo (Horse-shoe Reef) lies 9½ miles 325° of Nairai. It is of the atoll order, awash at half tide, and has but one very narrow opening on the northwest side to a basin of 12 fathoms in depth. The passage between this reef and the northern boundary of Nairai Island barrier reef is 7½ miles in breadth.

Situated, as it is, in one of the principal thoroughfares, this reef, upon which the sea seldom breaks heavily, is one of the most dangerous in Fiji.

Mbatiki (lat. 17° 46′ S., long. 179° 10′ E.). of volcanic origin, is a deeply indented island 2 miles in diameter, lying near the center of the Fiji Group; it is elevated 609 feet, and skirted by a reef which extends ½ mile beyond the coast line. There are three openings accessible to boats on the northern coast, and which may separately be found, by bringing the peak to bear 272° and 232° and 123°. The opening on the northwest side of this island is the best for a boat or small craft to find shelter in, bearing in mind that the entrance, and tortuous passage through the coral patches to the lagoon, does not admit a greater draft than 5 feet. This island produces all the roots and fruits common to Fiji, which, with pigs and poultry, sustains a considerable community.

Tides.—It is high water, full anl change, at Mbatiki at 6h. 9m.; springs rise 4 feet.

Kandavu Island, with the smaller adjacent islands, situated southward of Viti Levu, the principal island of the Fiji Group, are generally the first landmarks seen by those coming from the Australian Colonies.

Kandavu Island is about 32 miles in length east and west, and varying in breadth from ½ mile to 8 miles. At Tavukie Isthmus, it is nearly divided, the range of hills entirely disappearing, and at Ndaku Isthmus, it is only ¾ mile broad, the range lowering to a height of 200 feet.

Kandavu is of volcanic origin, and has some high mountains, of which Mbuke Levu, or the great Yam heap (Mout Washington), is most conspicuous, rising to a height of 2,750 feet above the sea.

On the southern side, the island is well wooded, but on the northern, or lee side, there is less forest, and in many parts grass.

Coral reefs surrounds the island (broken in many places opposite to fresh-water streams), and in some parts takes the form of a barrier, with navigable water inside.

Northeastward of Kandavu, are a number of small islands and rocks, surrounded by coral reef, which is continuous on the eastern side for a distance of 25 miles, but has several pasages on the western; this long stretch of coral is named the Great Astrolabe reef. Northward of Great Astrolabe Reef, and separated from it by a deep channel, is North Astrolabe Reef, which incloses a lagoon, in the center of which is a volvanic rock named Solo (The Stone).

Landmark.—When making Kandavu from the southward, Mbuke Levu, situated near the western extremity of the island, is first sighted, appearing in the form of a truncated cone, which can be recognized in clear weather at a distance of 50 miles. The northern part of the mountain attains an altitude of 2,750 feet.

Cape Washington is the extremity of a spur extending 1½ miles westward from Mbuke Levu, which takes the form of a rocky bluff, about 100 feet high, and is fringed by a narrow coral ledge.

Light.—A fixed white light has been established on this cape, elevated 208 feet above high water, and visible 16 miles. It is shown from a white square tower 28 feet high, erected on the summit of the cape.

Denham Island, about 1.3 miles 191° of Cape Washington, is a coral island, about 10 feet high, honeycombed by the sea, and having a clump of palm trees on its eastern end; it is connected with Kondavu Island by a coral reef, which extends 179° from the clump of palm trees for nearly 1 mile. Small vessels can be anchored during south and east winds between Denham Island and the main.

Between Denham Island and Cape Washington the coast is bold and rugged, cliffs rising in one part to a height of 300 feet. In this vicinity the numbers of headless palm trees shows the violence of the gales which occur here during the hot months (December to April).

Uthuna Mbuke Levu terminates the spur on the southwest side of the mountain of the same name. Between this point and N'galoa Harbor the coast takes an easterly direction and is irregular in outline and fringed by coral reef.

Thikombia is a precipitous, dark, rocky headland, 420 feet in height, appearing from a distance like an island, with trees on its summit. It is connected with Kandavu Island by a sand spit.

A coral bank having 2 fathoms water, and upon which the sea breaks heavily with strong winds, is situated ½ mile 190° from Thikombia.

Tomba ni Ndavingeile is on the east side of Thikombia, extending to Koro e Rangi, and measures about 2 miles across by 1 mile in depth. It affords indifferent anchorage, as the central part of the bay is encumbered with numerous coral heads, on which the sea breaks in blind rollers and the swell curls around the reefs at the entrance.

The native town of Ndavingeile, situated at the head of the bay, is the capital of the district of Mbuke Levu.

Koro e Rangi.—The peninsula of this name, the southeast point of which lies 3 miles eastward of Thikombia, has, like the latter, the appearance of an island, being connected with the mainland of Kandavu by a narrow sand spit ½ mile in length, over which the natives drag their canoes to avoid the rough passage outside the reefs. The summit of Koro e Rangi, 520 feet high, is covered with grass and slopes gradually down to the sea. Coral reef fringes its shores, extending 257° from the southeast point for about 2 miles and forming a spit, upon which the southerly swell breaks with violence, even in the finest weather.

A conspicuous tree is situated on the coast ridge east-northeastward of Koro e Rangi, about 350 feet above the sea, forming a good mark.

Matanuku Island, the southernmost of the Kandavu Group, is 570 feet high, steep-to seaward, covered with grass, and its south point bears from the southeast point of Koro e Rangi east, distant 5 miles. The coral fringe forms a point, which bears 218°, distant 1.3 miles from the summit of Matanuku Island. There is a village on the western coast of the island. The coast between Matanuku Island and Koro e Rangi has two considerable bights blocked with coral reef which extends about 1 mile from the shore; over this coral reef a boat can pass at half tide; but the boat passages through the outer edge of the reef can be entered only in the calmest weather. Similar reef connects Matanuku Island with Kandavu.

Tomba Ya uravu, immediately eastward of Matanuku Island, forms a harbor 2 miles in length northeast and southwest by about 1 mile in breadth, available for steamers and affording anchorage in from 14 to 16 fathoms, muddy bottom. The entrance, however, is 800 yards in length by 200 yards in width, and, being directly open to the prevailing southeast wind, departure in a sailing vessel is hazardous except with an offshore wind, which is of rare occurrence.

Upon the coral reef in the western part of Tomba Ya uravu are five small islands covered with bush, and there is a conspicuous black rock on the coral fringing the north side of the harbor. Between this anchorage and N'galoa Harbor boats can pass over the reef at three-quarters flood at spring tides and during light winds, but with strong winds the breakers extend close in to the beach.

N'galoa Harbor, on the southeast side of Kandavu, is protected from the southeastward or seaward by the reefs fringing that part of the island. N'galoa Island, about 1¾ miles in extent, is situated in the northwest part of the harbor, forming to the northeastward North Bay, to the westward Inner Harbor, and to the southwest Outer Anchorage.

Landmark.—There is a dip in the land to the northeastward of a remarkable gap in Kandavu Hills, which appears almost to divide

Kandavu Island; this will point out the position of N'galoa Harbor if N'galoa Island can not be made out, for, as the latter appears under high land, it often can not be seen till the vessel is within from 6 to 8 miles of the entrance.

North Bay is about 2 miles long in an east and west direction and 1 mile broad with depths of 19 to 20 fathoms near the center; bottom, sand and coral.

Inner harbor is about ½ mile in extent, with from 4½ to 6 fathoms, muddy bottom.

Outer anchorage has depths of from 16 to 20 fathoms, muddy bottom; on the west side of Outer Anchorage a mud flat fringed by coral reef, dries 400 yards from the Kandavu shore, having 6 fathoms close to the edge in some parts, with patches of 2 and 3 fathoms at 150 yards, and 6 to 9 fathoms nearly 600 yards from the reef.

Wood Shoal, with rocks awash at low water, lies on the southeastern side of Outer Anchorage, bearing 153°, distant 900 yards from the south point of N'galoa Island. It is marked by a black beacon.

Channels.—Main channel leading into N'galoa Harbor is formed by Esk Reefs on the north and Pearl Reef on the south side, the channel is about 600 yards broad with a depth of 40 fathoms near the center; at the inner entrance of Main Channel, 400 yards, 331° from the northwest end of Pearl Reef, lies McGregor Patch, which dries at low water. Between McGregor Patch and the east extreme of N'galoa Island there are several spots of 2 and 3 fathoms, with 6 to 8 fathoms close-to.

Vessels making for Main Channel from seaward should steer for Koroh to Sarra, a conspicuous peak 1,643 feet high, of sharp conical shape on the west side of the harbor, until the breakers on Sea Reef are discerned, and thence steer along its edge to the Main Channel of N'galoa Harbor.

Boat channel, between the Esk Reefs, is about 300 yards long and 50 yards broad, with a depth of 3¾ fathoms.

Schooner Channel is an opening in the fringing reef ¼ mile eastward of Boat Channel and is about 150 yards broad, with 10 to 12 fathoms near the center; on the northeast side of the inner entrance of Schooner Channel there is a patch of 1¼ fathoms. The west extreme of Anda Tavie Island, bearing 339° leads westward of this patch.

Beaching grounds.—Small vessels can be safely hauled up for repairs on a steep sand beach at the northwest point of N'galoa Island. A clump of palms marks the spot, which has a historical interest, as being said to have been the scene of the last cannibal feast in Fiji.

There is also a beaching ground on the northeast coast of the island.

Sea Reef, which forms the chief protection to N'galoa Harbor, extends 4½ miles eastward of the western shore of the harbor; it dries in patches at low-water springs.

Tavuki Isthmus, at the head of the inner harbor at N'galoa, is 900 yards broad, and is covered with palm trees, through which a path has been cut by the natives for convenience in hauling boats across from one side of the island to the other.

Anda Tavie Island marks the northern limit of N'galoa Harbor; it is 165 feet high, and surmounted by a banyan tree.

Tides.—It is high water, full and change, in N'galoa Harbor at 6h. 38m.; springs rise 5 feet 3 inches, neaps 4 feet 5 inches.

Tomba ni Soso, the continuation eastward of N'galoa Harbor, takes its name from the native village Soso, situated upon its eastern shore. Southeastward of Soso is Chomah, another village of importance. Paths lead from these villages, through the forests, to the north side of the island, and to Kasaleka.

A conspicuous clump of palm trees crown the summit of the peninsula which form the east side of Tomba ni Soso; these trees are 500 feet above the sea, and form a useful mark in passing along the coast.

Na Korotu is a black conical hill, 1,260 feet in height, in the backbone range of Kandavu Island, overlooking Soso Bay.

Ndaku Isthmus is situated at the head of Soso Bay. The range, some 1,500 feet high, dips here to a height of about 200 feet, and the island is only 1,300 yards across.

Barrier reef.—Between Schooner Channel of N'galoa Harbor and Uthuna Ngara Levu (the point which terminates the peninsula on the eastern side of Tomba ni Soso) the barrier reef makes a bight parallel with the coast, at the head of which bight is Soso Passage, 300 yards broad, and available for small sailing vesels, as the prevailing winds blow across it. Soso passage bears 66°, distant 4½ miles from the east points of N'galoa Island. Vessels can pass inside the barrier from N'galoa Harbor to Soso. Between Tomba ni Soso and the bay, at the head of which is Kandavu Town, the reef joins the shore in several places.

Vessels drawing 6 feet can pass over the reef at high water spring tides, if advantage be taken of the deeper pools, and ordinary whale boats can pass at a quarter flood.

Mount Challenger.—Several ridges traverse the eastern portion of Kandavu Island in different directions, their common center being Mount Challenger, which is 2,180 feet high. It has a well-defined peak, is regular in outline, and of a dark color, being covered with forest.

Islet.—At 4½ miles 100° of Soso Passage is a small islet with a clump of palms, on the coast reef, with two small rocks northeastward of it.

Kandavu Town, situated in a deep bay 6 miles eastward of Soso Passage, is one of the largest in the island.

Coral reef.—The barrier reef extending along the south coast of Kandavu forms a dangerous spur 3 miles southward of Kandavu town, upon which the sea breaks heavily even in light winds.

Tomba ni Koro Levu (lat. 19° 02′ S., long. 178° 24′ E.), 3 miles southeastward of Kandavu town, and the approach to that town, affords anchorage at its head in 12 fathoms, mud, northward of a coral reef which is awash at low water.

Sailing vessels, however, should not be taken into this bay, as the entrance through the barrier reef is narrow and the prevailing southeast wind blows directly into it, rendering departure difficult.

Koro Levu Passage into Tomba ni Koro Levu, formed by a break in the barrier coral reef, is about ½ mile long southeast and northwest, by about 200 yards in breadth. There is a depth of 54 fathoms between the outer horns of the barrier, 28 fathoms halfway through, and 32 fathoms between the inner horns. A current sets to the westward, with strong trade winds past the entrance, and the sea breaks with violence upon the outside horns of the reef.

Supplies.—Fowls, eggs, turkeys, yams, and taro can occasionally be obtained in small quantities. Fresh water is of doubtful quality and not recommended.

West Islet, 25 feet high, with casuarina trees growing upon it, is situated about 1 mile westward of Koro Levu Passage.

East Islet is rocky, 69 feet high, and lies ½ mile northward of Koro Levu Passage.

Caution.—Should a sailing vessel resort to Tomba ni Koro Levu warning is given not to pass out to seaward through the Koro Levu Passage with the wind from southwest through south to northeast, and the hour of departure should be timed so as to allow of a good offing being made outside the reef with the ebb tide.

The coast of Kandavu between Koro Levu and Uthuna Naingoro, the eastern point of Kandavu, has two deep indentations and several small rocky islets.

The barrier reef between these two places has two breaks in it, the northern of which, named Naingoro Pass, is about ½ mile long and 160 yards wide, and can only be used in daylight and the finest weather by steamers, or by small sailing craft with a commanding breeze. In bad weather the sea breaks across the entrance.

This passage affords a means of reaching Ono Channel and thus avoiding the longer round of Astrolabe Reef. There is a narrow channel inside the barrier, between Koro Levu and Uthuna Naingoro, which, at about 2 miles northeastward of East Islet, for a distance of 400 yards, narrows to a breadth of about 50 yards and is about 4 fathoms deep, and should only be used by small craft under favorable circumstances.

The east coast of Kandavu from Uthuna Naingoro takes a northwesterly direction, curving round for about 6 miles into Tomba Kaivala. Two hills attract attention on this coast, one of a burnt appearance and 940 feet high; the other, a densely wooded and conical hill, 1,220 feet high, near to and marking the entrance of Tomba Kaivala.

Ono Channel, within Naingoro Pass, and between Kandavu and Ono Island, has a number of coral heads, and should not be attempted except in bright weather and with the sun in a favorable position for seeing reefs.

Ono Island (lat. 19° 05′ N., long. 178 29′ E.) is the largest of the detached islands of the Kandavu Group; it is 4½ miles in length by 3½ miles in breadth. The highest peak in the island, named Mbualu, is 1,160 feet above the sea, and conspicuous. There is also a sharp peak near the center of the island, 1,110 feet in height, and near the southern extremity is a grassy hill 560 feet high, the land between it and the main part of the island dipping considerably, thus causing it to appear from a distance as a separate island. Ono is densely wooded on its eastern side, and partially on its western, and is surrounded by coral reef, which nearly joins the east side of Great Astrolabe Reef, the passage between being about 50 yards broad and the depth 17 fathoms over a bottom of coral.

Water can be obtained from a stream on the north side of Ono Island.

Tides.—It is high water, full and change, in the sandy bay on the northwest coast of Ono Island at 6h. Springs rise 6 feet and neaps 4½ feet.

Vuro Island, attached to the northeast point of Ono Island by coral reef, is small, about 270 feet in height, covered with trees, and is uninhabited. Vuro lai lai (Little Vuro) is a rock 90 feet high, covered with bush, situated on the connecting reef between Ono and Vuro Islands. Yambu Island is small, 170 feet high, thickly wooded, and bears 314°, distant 1¼ miles from Vuro Island. It is uninhabited. There are several rocks near and around Yambu.

Mbulia Island (Blunt), 32°, distant 1½ miles from Vuro Island, is nearly covered with grass, and has a well-defined summit 460 feet high. There is a village on the south side of the island and some cultivation.

Yaukuve Island (May) is 400 feet high, covered with grass and uninhabited. There is anchorage in 3 fathoms, sand, on its western side. Care must be taken in picking up a berth, to allow swinging room clear of the coral patches. Yaukuve lai lai (Little Yaukuve), 210 feet high, is covered with light colored grass, and is uninhabited; coral reef joins it to Yaukuve. Stretching off the south point of Yaukuve lai lai, in an easterly direction, is a reef of black rocks.

Ngasi mbali is a low, uninhabited island, with a hump at either end, each 60 feet high; between the humps there is a grove of palms. Nmara is a grassy island, having a few trees growing upon it; it is 230 feet high and uninhabited. Yanu yanu eloma is a small grassy islet 140 feet high. Yanu yanu sau is a small grassy islet 80 feet high, with a single coconut tree growing upon its summit.

Ndravuni Island (Colvocoressis) is about 1¼ miles in length north and south, by about ¼ mile in breadth, and rises to a hump at either end; that to the south, about 350 feet above the sea, being the higher. The land is partially cultivated, and has a village situated upon its eastern side. Off the northwest part there is anchorage in 4 fathoms, sand, protected from the prevailing southeast wind. Vanua Kula Island (Reynold) is 250 feet high and covered with vegetation. It is uninhabited.

Great Astrolabe Reef.—From Naingoro Pass the barrier reef takes a northerly direction, without an opening, for a distance of 25 miles.

The reef forms an elbow, which bears 106°, distant 3½ miles, from Mbulia Island (the easternmost of the islands, stretching northward from Kandavu Island), upon which the sea breaks heavily in almost all weathers. Northward of this elbow the sea breaks lightly upon Great Astrolabe Reef, and it is therefore most dangerous to approach, especially at night.

On the west side Great Astrolabe Reef is much broken. Between the north extremity of the reef and Ono Island are three passes, through which a vessel might navigate, named, respectively, Usborne, Herald, and Alacrity Passes. Southward of Alacrity Pass the reef becomes split up into small patches, among which navigation is difficult for any but small craft.

Caution.—The sea upon the west side of Great Astrolabe and North Astrolabe Reefs seldom breaks, and it breaks but lightly on the north and east sides of North Astrolabe. It is difficult to distinguish these reefs at night, at which time they should not be too nearly approached.

Diamond Rock, just within Herald Pass, has 6 feet water over it, and lies with Vanua Kula bearing 52°, distant 2¼ miles.

Astrolabe Lagoon comprises the sheet of smooth water in which the northern islands of the Kandavu Group are situated and is navigable on a bright day, with a good lookout from the masthead.

Anchorage.—The best in Astrolabe Lagoon is on the west side of Yaukuve and Ndravuni Islands, but as the greatest depth in the lagoon is 22 fathoms temporary anchorage may be obtained in most parts of it, bearing in mind that the lead is of little use in indicating the approach to a coral head and that other dangers may exist besides those marked upon the chart.

Alacrity Rocks.—The broken chain of reefs forming the western side of the Astrolabe barrier is terminated by Alacrity Rocks, which form a dangerous cluster off the northwest coast of Ono Island. The principal patch, upon which the sea breaks at low water, bears 319°, distant 2 miles from Mbualu Peak; near it are numerous coral heads.

Mayo and Swanston Rocks are three coral heads at the western entrance of Ono Channel (separating Ono from Kandavu Island); of these Mayo Rock bears 243°, distant 1¾ miles from Mbualu Peak and Swanston Rocks, consisting of two coral patches close together, bear 224°, distant 2¾ miles from the same peak.

North Astrolabe Reef is situated to the northward of Great Astrolabe Reef, from which it is separated by d'Urville Channel, 1 mile wide. The reef incloses a lagoon, about 4 miles in length, north and south, by about 3½ miles in breadth, in which anchorage may be obtained in about 12 fathoms, over a bottom of sand and coral. There are two entrances on its northern side, named, respectively, Beagle and Renard Passages. Of these the western (Beagle) Passage is the better, the eastern (Renard) Passage being available only for small vessels in very fine weather. The tide rushes swiftly through these channels.

Solo (North Rock) is situated near the center of the lagoon inclosed by North Astrolabe Reef.

Light.—A lighthouse, 106 feet high, painted in red and white horizontal bands, stands at Solo, from which is exhibited at 96 feet above high water a fleshing white light visible 15 miles.

D'Urville Channel separates North and Great Astrolabe Reefs and is about 1 mile wide. A sounding of 190 fathoms, coral bottom, was obtained on the southern side of the fairway of this channel.

Tomba Kaivala, or, as it is sometimes called, Tomba Lawake, is situated on the northeast coast of Kandavu Island and forms a harbor about 1¼ miles in length by ½ mile in breadth, where safe anchorage can be obtained in from 12 to 16 fathoms over a muddy bottom. Near the south part of the bay is a steep peninsula resembling an island 320 feet high, connected on its south side with the coast of Kandavu Island by a mangrove marsh.

Kaïvala Bay is surrounded by mountains covered with forest from base to summit of picturesque appearance.

When entering Kaivala Bay care must be taken to avoid two detached coral patches on the western shore and a coral spit which stretches out for a distance of 400 yards from the east point of the harbor.

There are four villages in Kaivala Bay, namely, Kaivala on the west side of the bay, Lawake behind a grove of high mangroves to the southwest, Solo Tavui to the south, and Ninderi to the northeast.

Water is easily obtained from a stream 200 yards south of Ninderi village.

Tomba ni Kasaleka (lat. 18° 56′ S., long. 178° 22′ E.).—From Kaivala Bay the coast of Kandavu Island takes a westerly direction for 2 miles to Kasaleka Bay, which is small but has sufficient room for small vessels to anchor. On the west shore of the bay is a large white patch on the cliffs, conspicuous from the eastward when the sun shines upon it.

Off the mouth of Kasaleka Bay, to the northward, are two detached coral patches named, respectively, Malan Patch and Kasaleka Reef.

Kasaleka town, at the head of the bay, is the largest in Kandavu Island. Fresh water can be obtained.

The coast from Kasaleka Bay trends westerly for 3 miles to Yale Point, which is rocky and has two trees standing upon its edge. A coral reef extends for 670 yards to the northward of the sandy spit which extends eastward of Yale Point, on the west side of which coral reef there is a boat harbor.

Mount Yale, the northern high peak of Kandavu, is well defined and 1,180 feet high, with a tolerably regular slope on all sides, covered with light-colored grass. Water can be obtained at high tide from the stream which runs down from Mount Challenger to Yale Village. There is anchorage in 12 fathoms, coral and mud, off the east side, and about 400 yards distant, from the edge of Yale Reef.

The coast from Yale Point to Uthuna Moindule takes a general west-by-south direction for 9 miles, and is fringed with coral reef having several outlying dangers. There are two bays in between, named Naseile and Ndaku, off both of which an anchor can be dropped outside the coral heads.

The principal outlying dangers are Ham and Rooper Reefs, situated nearly 1 mile from the shore.

The most conspicuous hills near this part of the coast are Na Korotu and Mount Chalmers, the latter being a square-topped hill about 1,400 feet high. There is also a conspicuous clump of palms on a spur of Mount Chalmers, westward of which the range of hills becomes densely wooded.

The Asses Ears is a well-marked double peak over Uthuna Moindule, conspicuous from northeast and southwestward.

The coast from Uthuna Moindule takes a southwesterly direction for 1½ miles to a well-defined rocky point, from whence it trends nearly straight for 3½ miles in a southerly direction to Tavukie Isthmus.

The natives of Malatta Village, situated upon Tavukie Isthmus, can be hired to drag boats across the isthmus to N'galoa Harbor.

Those in small vessels wishing to communicate with Wai Levu in N'galoa Bay often make for the north side of Kandavu Island in strong trades, and anchor off Malatta.

From Tavukie Isthmus the coast curves around in a westerly direction for about 2 miles to John Wesley Bluffs, which are a line of reddish cliffs about 500 feet high, and conspicuous from the northward.

Malatta Reefs.—Stretching westward from Uthuna Moindule, and following the southwesterly trend of the coast, at a distance of about 2 miles from it, are the Malatta Reefs. Vessels can enter between the barrier formed by these reefs and the shore, but the navigation is difficult, on account of the numerous coral heads.

Tomba ni Tavuki, having Tavuki Village situated near its head, is about 1 mile southward of John Wesley Bluff. The shore reef extends to a point 1 mile northward of the village, and there are numerous coral heads outside.

The west extreme of John Wesley Bluff in line with the slope of Koroh-to-Sarra 156° leads into Tavuki Bay, and clears the reefs at the entrance. The reef on the western side extends into the anchorage and reduces its size.

Richmond, known to the natives as Richmondi, is the next village on the north coast of Kandavu, westward of Tavuki, from which it is distant about 2½ miles.

For many years Richmond was the side of the Wesleyan school for native teachers, but now takes a secondary place to the Navuloa Station, situated at the mouth of Rewa River in Vitu Levu.

The mission station is marked by a conspicuous house, situated on an isolated hill, 400 yards from the beach of Richmond Bay (Tomba ni Richmondi), which here indents the coast, and there is a large stone building on the lower ground.

Hope Reef lies 2 miles 38° from the mission station at Richmond and breaks at all times of tide. A coral head 30 feet in diameter, and having a depth of 5½ feet on it at low water and 10 fathoms close to, lies with center of Hope Reef, bearing 314°, distant 1 mile.

Tomba ni Richmondi, just alluded to, affords protection for small vessels in nearly all winds. At 1½ miles westward of Richmond Village is Yawi Village. The fringing reef here extends 1¼ miles from the coast, affording protection to Richmondi Bay from the westward.

Dawson Reef is detached and of coral, awash, about ¼ mile in extent, and separated from Yawi Reef by a channel about a ¼ mile wide, which abounds in coral heads. It lies 5½ miles 55° from Cape Washington, the coast between forming Tulaulia Bay.

Tomba ni Tulaulia is the westernmost bay upon the north coast of Kandavo, and remarkable for the enormous size of the shingle found upon the shore of its eastern part. The western point of the bay is Cape Washington.

Anchorage may be found about the middle of the bay, off Ndongai Village, in 10 fathoms, ¼ mile from the shore; and safe landing can be effected through a boat passage in the narrow fringing reef.

VITI LEVU—SOUTHEAST COAST.

General remarks.—Those in sailing vessels bound for Suva during the trade wind months, from New Zealand or the Australian colonies, should endeavor to make sufficient easting to enable them to pass to windward of the Astrolabe Reefs, and thus obtain a commanding position for bearing down on the port. Those in steamers can make Mbuke Levu (Mount Washington) and passing close to Cape Washington steer through Kandavu Passage on a straight course for Suva. With the wind northward of east, which is not unfrequent, sailing vessels can not lay through the passage, and in strong trade winds, a surface current to the westward has been experienced in the neighborhood of Mbengha Barrier Reef. In thick weather, however, when an approach to Astrolabe Reefs is attended with danger, or when the wind is from the westward Kandavu Passage is the best route. When working to windward, preference should be given to the south side of the passage.

On leaving Suva for the Australian Colonies, Kandavu Passage is the best route for all classes of vessels, Mount Washington affording an excellent point of departure.

Landmarks.—On making the south coast of Viti Levu in the neighborhood of Suva from the southeastward, the most conspicuous landmarks are Rama (thumb-shaped peak) and Na Komba Levu (round mountain). After passing North Astrolabe Reef a course should be steered for Na Komba Levu, thus keeping a little to windward, and the reef followed down to the entrance of the harbor.

Suva Harbor (Tomba Ko Suva), situated on the south coast of Viti Levu, westward of Suva Point, is about 2 miles long, east and west, and from ½ to 2 miles broad; the land in the neighborhood of Suva Point being about 200 feet high, protects it from the prevailing easterly wind, which, however, seldom veers to the southward of southeast by south; while the reef forming the southern part of the harbor, renders the water invariably smooth, and the shores, except immediately northward of the entrance, without surf or break; the bottom is mud. The approach is deep and available for all classes of vessels.

Inner Harbor (Nai Ngalo Ngalo) offers complete shelter for several vessels in depths of from 5 to 8 fathoms, mud bottom.

The entrance is through a clear opening in the reef, 600 yards broad, having in mid-channel about 40 fathoms; the harbor is available for all classes of vessels.

Walou Creek, on the east side of the harbor, extends about ¾ mile inland and is bridged across the entrance, connecting Suva town with the hospital, etc.

Cliffy Point.—A small white native church, with red roof, is situated among the trees on this point.

Lights and leading marks.—Leading lights on conspicuous beacons painted white are shown at the head of Suva Harbor. The towers or lights, in line, bearing 10°, leads through the entrance.

The lower light, 130 feet above high water, is a fixed red light, visble in fine weather for a distance of 12 miles between the bearings 319° and 38°.

The upper light is fixed white, elevated 338 feet above the sea, and is visible 14 miles, between the bearings 325° through north, and 55°. It bears from the lower light 10°, distant 1,350 yards.

From the dolphin marking the southern edge of the reef extending southward from Cliffy Point is exhibited a fixed white light, when vessels are leaving the harbor at night.

Two green lights are shown over the harbor from Queens Wharf.

From a square white house on black piles, erected on the northern end of the coral bank on the east side of the entrance, is exhibited two fixed white vertical lights 6 feet apart, at heights of 23 and 30 feet above high water.

From the lighthouse the Roman Catholic Cathedral bears 101° distant 1.3 miles.

Buoys.—All the important dangers near the fairways are marked by buoys or perches, as necessary, and their positions are liable to be shifted. White beacons or buoys are on the starboard hand on entering, and black on the port hand.

The wreck of the bark *Norden* (1901) lies on the southern edge of the western reef at the entrance, 233°, distant 1,300 yards from the new pile lighthouse.

Anchorage.—The best line on which to anchor is with the dolphins on Queens Wharf in line with the customhouse flagstaff.

Coal.—Two coal hulks are moored in about 12 fathoms off the wharf; about 1,000 tons is kept in stock, 3,000 tons imported annually.

Coaling can proceed at all times.

Suva town, the seat of the government in Fiji, is on the eastern shore of the harbor. It contains a hospital, situated north of Walou Creek, besides churches and public buildings. Government house is situated southward of the town.

The Roman Catholic Cathedral is a conspicuous white stone building with a gray roof, surmounted by a large white statue. The baths, situated about ¼ mile southward of Queens Wharf, are red and conspicuous.

A high conspicuous flagstaff is erected close to the customhouse.

Wharf.—Queens Wharf is 330 yards in length, including the outer arm. Fixed green lights are exhibited at the elbow and at the extreme of the outer arm. There is a short arm charted just within the outer arm.

Water is laid on by pipes and can be obtained at 1 shilling per tun.

A signal station has been established on a hill 106° distant 1,800 yards from the cathedral.

Radio.—A radio station available for commercial messages has been established at Suva; call letters, V P D.

Time.—By courtesy of the telegraph company a time signal from Brisbane can always be obtained by giving two days' preliminary notice at the office.

Quarantine regulations are strictly enforced; all vessels must fly the yellow flag until permitted to haul it down by the health officer.

Ships in quarantine are anchored in the north side of the harbor.

The quarantine station is situated upon an island in the inner harbor.

Telegraph.—The telegraph cable is worked from a house standing between two posts with triangular topmarks and the inscription "Cable." The cables lead from the house and pass on either side of Thurston Patch and around the lighthouse to sea.

Directions.—Na Komba Levu, a mountain 1,446 feet high, situated about 3 miles inland, and northward of Suva Harbor, bearing 10°, will lead from the offing and up to the entrance, when the two lights or beacons on the north side of the habor in line on a 10° bearing will lead in; when Suva Pier bears 106°, course may be shaped for the desired anchorage.

Caution.—Those in sailing vessels should not attempt to enter at night or too early in the morning without a pilot, as they are liable to lose the wind when in the passage.

Inshore passage.—There is a narrow channel inside the reef between Suva Harbor and Lauthala Bay, about 3 miles eastward of it. This channel is buoyed and beaconed, and insures a smooth-water communication between the two harbors; vessels of 500 tons can be towed around in calm weather. When leaving Suva by this channel all the white marks must be left to port and the black to starboard.

Tides.—It is high water, full and change, in Suva Harbor at 6h. 56m.: springs rise 4½ to 5¾ feet, neaps, 3¼ to 4 feet.

Tomba Ko Lauthala (Lauthala Harbor) 3 miles eastward of Suva Harbor, and separated from it by Suva Point, is a convenient anchorage for vessels shipping sugar from the plantations on Rewa River. It is about 2 miles long by 2 miles broad, and has good holding ground in from 3 to 12 fathoms, muddy bottom, well protected by the barrier coral reef, which dries at half ebb.

The entrance, named Ndaveta Nukumbutho, is 300 yards wide, and situated midway between Suva Point and Nukulau Island. It is marked by a conspicuous sand bank (awash only at high spring tides), situated on the inner point of the eastern side of the passage, and off which extends a short sand spit.

The principal coral patches in the eastern part of the harbor are buoyed and beaconed.

Beacons.—The following beacons have been established in this harbor:

A beacon on the southeast extreme of the reef, at 1,800 yards 330° from the outer end of the pier, Nukulau Island.

A white beacon on the 1¼-fathom shoal, at 1.1 miles 297° from the outer end of the above-mentioned pier.

A white beacon on a 1½-fathom shoal, at 1,840 yards 300° from the outer end of the above-mentioned pier.

A beacon on the northern edge of the shoal, at 1,400 yards 298° from the outer end of the above-mentioned pier.

A black beacon on the northern end of the 2-fathom shoal, at 1.8 miles 129° from the flagstaff at Government House, Suva.

A black beacon, on the southern side of the Narrows, at 1,920 yards 167° from the above-mentioned flagstaff.

Port Nukulau, at the extreme southeastern part of Lauthala Bay, is a good harbor for shipping produce from Rewa River. It may be entered either by the Ndaveta Nukulau from seaward, or by the passage leading from Rewa Roads between Nukulau and Mokaluva Island.

Sailing vessels, however, can not leave Port Nukulau until the trade wind is from northward of east, and it is also advisable to depart with the ebb tide.

Ndaveta Nukulau, the entrance to Port Nukulau, is 300 yards broad at the mouth and narrows inside to a breadth of 200 yards. It lies nearly north and south. No attempt should be made in a sailing vessel to enter against the tide unless there is a commanding breeze.

Between Lauthala Bay and Port Nukulau there is easy communication inside the barrier, between the coral reefs which divide the two anchorages.

Anchorage can be obtained in from 7 to 12 fathoms, sand and mud, well protected by reefs in all directions.

Rewa Roads afford an open anchorage at the Nasoata mouth of Rewa River, which anchorage is probably formed by the alluvial deposit brought down by that river. Small vessels can obtain protection from the ordinary tide wind under the point of the reef south of Nasoata Island, but when selecting a good position for anchoring it should be borne in mind that the reefs are very difficult to see, especially after rain, on account of the muddy water from the river. With strong trade winds, or during the hurricane months, this anchorage must be considered as too exposed.

Belcher Rocks are a group of sunken coral heads at the west extreme of Rewa Roads. The sea nearly always breaks on them. The east end lies 1¾ miles 103° from Mokaluva Island.

The Delta of the Rewa is low and flat and without any distinguishing feature.

Na Komba Levu is a useful landmark. It is rounded, of dark color, about 1,446 feet high, and is the southeastern peak of Viti Levu.

Rewa River, the principal mouth of which is within Rewa Roads, is navigated by steamers of 50 tons, towing several laden punts of 200 tons capacity each, as far as the Colonial Sugar Refining Co.'s estate, distant 11 miles from the anchorage in Tomba ko Lauthala.

A vessel drawing 10½ feet can, from Rewa Roads, cross the bar of the Nukulau entrance and proceed up the river at high water spring tides, and in fine weather. The river is navigable for boats having power as far as Vunindrala village, 44 miles from the entrance.

Two white leading beacons are placed inside the Nukulau entrance, which, kept in line bearing 333°, leads in the deepest water over the bar.

(The Nukulau Entrance is reported to be filling up, and is seldom used, the most frequented channel being Nai Wakaya, which is entered from the northeastern part of Lauthala Harbor. 1915.)

Caution.—The above marks do not lead in from the offing, but only from port Nukulau.

The Wai ni mala branch of the river, which falls into Rewa River near Vunindrala Village, is very shallow, full of rapids, and only fit for small boats for 3 miles from this place or to Na koro vatu.

Nasilai mouth of Rewa River has good anchorage protected from all winds at port Nasilai, in 8 fathoms, sand, about 1,350 yards 235° of Na Vunivatu.

Navuloa or Kamba branch of this river, which debouches 3½ miles to the southward of Mbau Island, can only be reached through the Mbau waters.

Na Vunivatu (Stone on reef), is a mushroom-shaped rock, about 5 feet above high water, on the southern reef at the entrance to the Nasalai mouth of the Rewa. This large stone is conspicuous from the northeast or southwestward, when seen clear of the land about the delta of the Rewa.

Nasilai Reef extends 4 miles from the shore at the southeast extreme of Viti Levu, from Na Vunivatu to Nasoata Island.

Light.—A flashing white light is shown from a white circular concrete tower, 58 feet, situated on the southeast extreme of Nasilai Reef. It is visible 12 miles.

For details, see Light List.

Wreck.—The wreck of an iron ship, forming a conspicuous mark, lies sunk on the outer edge of Nasilai Reef, at about 400 yards 164° from Nasilai Reef Lighthouse.

Kamba Point is a narrow peninsula, 3 miles long and ½ mile wide, standing out in relief and appearing like an island, but without any remarkable feature. On the north side of it is the Navuloa mouth of the Rewa River, before mentioned; it is approached by Tomberua Passage.

The tufts of palm trees which surmount Kamba are 160 feet above the sea. Off the extreme point are two small islands named, respectively, Ndrala and Tongeravu, 90 and 70 feet high.

Tomberua Passage, leading into Mbau waters, is available for vessels of 11 feet draft. The channel passes between two sand cays, which show at half tide and are 300 yards apart.

Barrier reef.—**Mumbualau Island** is another conspicuous landmark between Suva and Levuka. It is of coral, narrow and low, being 450 yards in length by about 100 yards in breadth, and is planted with coconut trees, the tops of which are 90 feet above the sea. Situated ½ mile inside the edge of the barrier reef (eastward of Mbau), Mumbualan Island can be seen from the deck of a vessel at about 12 miles, and forms a valuable mark for making the Mbau coast, which is low and not easily seen.

Ndaveta ni Kalavo or Rat Passage, near Nanga Sautambu Island, is only of use for boats during fine weather. It is nearly 400 yards broad and has rocks between the inner horns of the entrance reef.

Moturiki Channel is nearly 1½ miles wide and admits vessels of any size and draft to the Mbau waters.

Moturiki Island, situated 1 mile southwestward of Ovalau, lies northwest and southeast, is 5 miles long by 670 yards to 1.3 miles broad. It is covered with coconut groves.

Yanutha Levu and Yanutha lai lai are two islands between Ovalau and Moturiki. Boats only can pass between Ovalau and Moturiki; the passage is 200 yards north of Yanutha lai lai.

Thangalai and Leleuvia are two small islands south of Moturiki, marking the narrowest part of the Moturiki Channel. The latter is covered with coconut trees.

Nanga Sautambu is a sand cay 3 feet high, situated 1¼ miles 243° from the south horn of the entrance to Moturiki Channel. It is about 100 yards in diameter and on its north side there is a conspicuous bush.

Mbau Waters is the name given to the lagoon, in which Mbau Island, at one of the mouths of the Rewa, is situated. Sunken coral reefs are here numerous, the lead giving no warning when approaching these dangers, and it is probable that there may be patches of coral other than those marked upon the chart; great vigilance is therefore necessary when navigating.

By passing through Moturiki Channel and between Leleuvia Island and Thangalai large vessels may navigate the Mbau waters as far as Viwa Island, but no directions can be given, and the vessel should be conned from aloft, with the sun astern.

The inner part of Mbau waters is apparently filling up with mud.

The islands Teilau, Viwa, and Mbau are difficult to see until close-to, being much the same height and color as the adjacent land.

Anchorage.—There is anchorage in Mbau Waters in 4½ fathoms, with the center of Teilau Island bearing 333° and south extreme of Viwa Island 257°; also in 5½ fathoms, with Viwa Island south extreme, 255°, and Teilau 319°.

Teilau Island is about 500 yards long east and west by 150 broad, and has several palm trees growing on its ridge, making the entire height of the island 100 feet above the sea. It is uninhabited.

Viwa Island is nearly 1 mile long by 670 yards broad and is about 160 feet in height throughout.

Mbau Island is small, and about 80 feet high. Vessels other than of light draft can not approach nearer to Mbau than 1½ miles, but boats may reach the shore at all times of tide.

Supplies.—All necessaries are brought from the neighboring province of Tai levu, and neither supplies nor fresh water can be obtained by ships.

Tomberua Islet is low and sandy, about 200 yards long by 100 yards broad and covered with palms about 80 feet high. It is situated in a direct line between Mbau and Mumbualau Islands, but nearer to the latter.

Boat navigation frequently takes place between Suva and Levuka. On leaving Suva by boat for Levuka it is best to arrange to be in either the Lauthala or Nukulau mouth of the Rewa, soon after half flood, which will be favorable as far as Wai ni mbokasi, which river should be descended to the Navuloa mouth, in Mbau waters, with the first of the ebb, on account of shoal water off Toka toka. The river being successfully passed through, steer past and westward of Tomberua Island, and thence on to Moturiki and Levuka.

At half tide ordinary whale boats can pass inside the shore reef on the eastern side of Moturiki Island, or through Nai Tasi Passage, if the breakers are not too heavy, but at low water it is necessary to go outside the reef as far as Ngava Passage, or a circuit to the westward of Moturiki must be made.

Small sailing vessels go around to the westward of Ovalau, if the wind be blowing strong from a direction to the northward of east.

Ovalau Island is 8 miles in length north and south by 6 miles in breadth; it is of volcanic formation, its rocks are composed of a conglomerate or pudding stone, and it is high and rugged throughout. The valleys only extend a short distance into the interior and leave but little level ground; they are, however, exceedingly fertile and well cultivated. The highest peak is 2,089 feet above the sea. From the summits of Ovalau the fantastic needle-shaped peaks of Vanua Levu are distinctly seen at times, though 60 miles distant. Its harbors are formed by reefs; that of Levuka, on its east side, is safe in ordinary weather, and is easy of access.

Levuka Harbor affords good anchorage sheltered by a reef which trends nearly parallel with the shore, from which it is distant nearly ½ mile, such protection rendering the water in the harbor generally smooth. It has been reported that the anchorage is not tenable in really bad weather. Heavy seas pass over the reefs awash at low water. Only one vessel remained at her anchor during the hurricane of January, 1895, and she cut her masts away. It is one of the two clearing ports of the colony.

Entrances.—Na Tumbari, or the south entrance into Levuka Harbor, is the one principally used. It is 330 yards wide between the 5-fathom line and can be entered or departed from under any circumstances by a steamer, but not by sailing vessels with both foul wind and tide.

An iron perch, colored red and surmounted by a cage, stands 30 yards inside the edge of the north elbow of the Mbalavu Reef on the south side of the entrance and 70 yards within the shoal water.

Waitovu or North Entrance is 800 yards wide, with an average depth of 7 fathoms, except in mid-channel, where there is a rock with 8 fathoms over it. It is much used by sailing vessels leaving the port with the wind from the eastward, for there is room to work out and a fair depth for anchoring, if necessary. A black buoy marks the south side of the passage.

Dangers.—There are coral patches in the harbor, of which the principal one, Ithi Thambi, lies 400 yards east of the observation spot at Niakombi Point; it dries at low water and has an iron perch with ball upon its center.

A rocky patch of 3½ fathoms lies 500 yards 134° from Niakombi Point and another of 3 fathoms 300 yards 139° from the same point.

Several patches lie off Nasova to the southward, to clear which do not open Ithi Thambi Perch of the land of Ovalau.

Directions—Leading marks and lights.—Leading lights are established upon beacons on the high ground above Levuka to guide vessels through the Tumbari or Southern and principal entrance to the harbor.

The upper light, 240 feet above the sea, is fixed white, and visible 16 miles; the lower, 193 feet, fixed red, and visible 5 miles; they bear 99° and 279° from each other and are 73 yards apart. The beacons are painted white.

The lights by night or the beacons by day in line on a 279° bearing, leading in mid-channel through the Southern entrance into Levuka Harbor, and, being close together, it is necessary they should be kept exactly in line.

On the headland southward of Nasova a fixed red light is shown between the bearings 187° and 210°. When entering the harbor with the leading lights in line vessels will be clear of the reefs on either side of the entrance when this red light comes in sight.

If intending to anchor southward of the line of leading lights, keep within the limits of the red light, but avoid anchoring on Middle Patch of 7 fathoms; when anchoring northward of that line alter course to the northwestward when the red light comes in sight.

Anchorages.—The usual berth for naval vessels is in the north anchorage, in 16 fathoms, sand and mud, with the perch of Ithi Thambi 201° and Mbalavu Perch 122°.

The south anchorage is in from 10 to 15 fathoms, sand, coral, and mud, about 600 yards southward of Ithi Thambi Perch.

Tides.—It is high water, full and change, in Levuka Harbor at 6h.; springs rise 5 feet, neaps 3 feet. The tide is felt but slightly at the anchorages, but runs swiftly in the entrances. When beating in or out of Levuka Harbor a favorable tide should be chosen.

Levuka town is situated in a valley with a stream of fresh water running through it to the beach.

It became important through the friendliness of the chief, Tui Levuka (who died in 1870), to the whites in the early days of settlement in this group. As the site of the most important town in Fiji it was found to be unsuitable, being built on a narrow strip of beach, which it occupies, with a double row of houses nearly 1 mile in length.

Wharf.—North of Naquima Point is Queen's Wharf, 133 yards in length, alongside which vessels of 18 feet draft can lie on the north side, and those of 12 feet on the south side; there is also a berth for a vessel of 18 feet draft alongside the addition to the wharf on the south side, which extends 500 feet in a southeasterly direction from a position 50 feet inside the head.

A fixed green light, 14 feet above high water, is exhibited from the head of Queens Wharf, and another similar light is at the head of the arm; visible about 2 miles.

A pier, parallel with Queens Wharf, extends 400 feet from a position 150 feet northward of it. The customhouse and post office are situated between the pier and wharf. A conspicuous Roman Catholic church, with square tower and clock, is situated 300 yards northward of Queens Wharf.

Supplies.—Levuka depends a great deal upon Sydney anl Auckland for supplies; they are occasionally both scanty and expensive.

Excellent water can be obtained from the pipe at the watering jetty.

Pilot.—The pilot for Levuka will come out to vessels upon the usual signal being made.

Quarantine.—Vessels entering the port of Levuka must fly a yellow flag at the fore, whether there be sickness on board or not, until permitted to haul it down by the health officer. A fine is inflicted if this regulation be neglected. Ships in quarantine are anchored near the north entrance in the harbor.

The quarantine station is on Thangalai, a small island off the south coast of Moturiki.

Observation spot, at Niakombi Point, is in latitude 17° 40′ 45″ S., longitude 178° 51′ E.

Rock.—A rock, awash at low water, and marked by a beacon, is situated on a 7-fathom bank westward of the southern point of Ruku ruku Bay.

Naingani Island, 5½ miles northwest of Ovalau, is triangular shaped, about 1 mile long north and south, and the same distance east and west. It has a well-defined summit at its northeastern end, 514 feet high.

Coral patches westward of Ovalau.—Both westward and northward of Ovalau, the waters are studded with coral dangers; no attempt can be made to describe them separately, the chart being the better guide. Patches may, and probably do, exist that are now uncharted, so that great care is necessary when navigating this part.

Kandavu Passage is the name given to the broad deep channel which has for its limits—on the south side the islands and reefs of Kandavu—and on the north side Vatu Leile, Thakau Lekaleka, and the Mbengha barrier.

Northern shore.—**Vatu Leile** is a low island, apparently of coral formation, and covered with palms, casuarinas, screw pines, and dense brushwood. It is 6¾ miles long, and varies from ¾ mile to 2½ miles in breadth, its greatest height, which is toward the northwest, being estimated at 110 feet; the western coast, on the face of its steep bluffs, shows curious indications of upheaval. The island slopes gently to the eastern shore.

As Vatu Leile presents a perfectly even and regular outline to the view it is difficult to make out in thick weather or at night. A coral reef, from 300 to 600 yards broad, and 3 feet dry at low water, fringes the western coast, but the north and east coasts are protected by a barrier reef, which, opposite the principal village, forms an elbow 2½ miles from the shore.

The general depth in the lagoon is about 4 fathoms, but there are several rocks off the northern shore which render navigation unsafe at low water for vessels drawng oiver 10 feet.

Situated on the northern part of the barrier reef are three islets, named, respectively, Vatu Savu, Vatu Levu, and Vatu lai lai.

Supplies.—The only supplies to be obtained are kumalas (the Fijan sweet potato) and yams, both in small quantities. No good water can be obtained.

Passages into the lagoon.—There are two passages into the lagoon of Vatu Leile Island, named Weather Passage and Lee Passage.

Weather Passage is 700 yards eastward of Vatu lai lai, and at the entrance Vatu lai lai and Vatu Savu are in line. A bowlder, 1 foot above high water, named Nai Rambo rambo, is situated on the edge of the 400 yards eastward of the passage.

It is suitable for the entry of sailing vessels with the wind between southeast and east-northeast. It is 80 yards broad at the mouth, and forks at a distance of 150 yards from the outer horns.

The northern branch of the fork should be chosen. Some rocks with 3 or 4 feet of water over them lie in the channel, but by careful conning from the masthead these can be avoided, and vessels of 10 feet draft may enter at low water. No attempt should be made to enter against the ebb tide. The courses through are 212° and 235°.

Lee Passage is the better for the exit of sailing vessels during the trade wind season if the wind is eastward of east by north, and is safe for both the entry and the exit of steamers drawing not more than 10 feet at any time of tide. It leads 500 yards eastward of Vatu Savu and is divided into two channels some few hundred yards from the entrance by a group of rocks. The weather channel is the safer.

Caution.—The entrances into Vatu Leile Lagoon should not be attempted unless the sun is in a favorable position, and a good masthead lookout is imperative.

Tidal streams.—In the north part of Vatu Leile Lagoon the flood sets south by east and ebb north by west, the stream taking the same course along the reef on the western side of the island.

Thakau Lekaleka (the Flying-fish Shoal) is 8 miles 89° from the southern extremity of Vatu Leile. It has a diameter of 1,000 yards and at low water is awash; there is generally a heavy break on it.

Mbengha Lagoon is the name given to the sheet of smooth water which is protected by Nanuku Reefs, Mbengha Barrier, and Yanutha Reefs. It contains the large island of Mbengha, and several others form the barrier. Like other coral lagoons of this character, the bottom is very uneven, and there are numerous coral heads and patches.

A general examination has been made of this lagoon, but it is possible that more dangers exist than are marked on the chart.

Mbengha barrier reef is a long unbroken coral reef, 21 miles in length, and varying in breadth from ½ mile to 1¼ miles, forming the southeastern side of Mbengha Lagoon, and having a prominent elbow 12¼ miles 227° miles of the highest peak of Mbengha Island. It is dry at low water and breaks heavily only on the elbow just mentioned.

Caution, therefore, is required when approaching it at night or in thick weather.

Nanuku Reefs are a continuation of Mbengha Barrier trending northwestward and affording protection to the island from the easterly swell. There are passages through Nanuku Reefs and between them and Pratt Reefs, which can be navigated with the ordinary precaution of a good masthead lookout.

Cutter Passage, between the Barrier Reef and Nanuku Reefs, is very narrow and should only be attempted in sailing craft with a fair wind and tide.

Storm Islet is a sand cay, 280 yards longs and 80 yards broad, northwestward of the center of the largest of Nanuku Reefs. It is covered with bushes and coconut and other trees, making its entire height 50 feet.

Pratt Reefs are a group of coral patches situated 2½ miles northwestward of Storm Islet, south side of Mbengha Passage.

Pearl Rock lies 2 miles 257° from the sand cay just mentioned, and consists of coral with 3 fathoms over it at low water.

Caesar Rocks are two small coral heads upon which the sea seldom breaks. They lie 2½ miles 49° from Bird Islet and have 6 feet water over them.

Nisithi Rocks.—Between Caesar Rocks and Thakau Nisithi the bottom is foul, being strewn with rocks about 6 to 12 feet below low water.

Thakau Nisithi is the name given by the natives to the coral reef upon which is situated Bird Islet, which is a small sand cay with a group of bushes on it, making its entire height 4 feet above high water.

Yanutha Island, 8 miles westward of Mbengha Peak, is one mile long by ½ mile broad, steep on the northwest side, but sloping to the southeast, partially cultivated. It has three peaks, the highest, which is the eastern, being 450 feet above the sea.

There is tolerable anchorage in 7 fathoms, sand, off the northwest coast, protected from the prevailing easterly wind. When steering to the northward from this island, a good lookout is necessary to avoid the coral heads between the Yanutha Reefs and Thakau Nisithi.

Yanutha Reefs, situated westward of Yanutha, are a continuation of the western part of Mbengha Barrier.

Frigate Passage, between Mbengha Barrier and Yanutha Reefs, is 1½ miles wide, with two coral patches in it, and is available for vessels of any size entering Mbengha Lagoon.

Mbengha Island, of volcanic origin, has two deep indentations named Malumu and Kovanga Bays, the former on its northeast, the latter on its western side. Neither of these bays can be recommended as harbors for sailing vessels on account of the baffling winds.

The greatest breadth of the island is 4 miles, and it has several high peaks, the northern, which is the highest and most precipitous, being 1,430 feet above the sea.

Portions of the island are under cultivation. Lemons and shaddocks grow wild in large quantities on the hills. The appearance of Mbengha is beautiful from all points of view, as it is covered with vegetation from the summits of the hills to the water line.

There are several villages, the principal of which is Wai Somo, on the north coast.

Stuart Islet is 1.3 miles 235° of the southwest coast of Mbengha. It is 300 yards in length, and 100 feet high, partially cultivated, but uninhabited.

Anchorage.—There is anchorage anywhere around the coast of Mbengha; but the water is deep, and the bottom rocky and uneven.

Tidal streams.—When at anchor between Storm Islet and Mbengha in July the surveyors found the flood stream setting to the southeastward, and ebb to the northwestward.

The coast—West of Suva—Aspect.—From Suva to Koro Levu the south coast of Viti Levu may be described as mountainous, densely wooded, and well watered. The highest mountains are in the neighborhood of Suva, one peak, Koro Mbasa mbasanga 18 miles 302° of Suva Harbor, attaining an altitude of 3,960 feet.

This peak is distinguishable from outside Suva Harbor in clear weather, and would be an useful mark for observing (in a steamer) for deviation of the compass.

The effect of being backed by such high mountains is to make Suva and the country to the westward a wet and misty locality, and while this doubtless is not a subject of regret to the planter, it is a serious inconvenience to the navigator approaching coral reefs, as to the existence of which the lead gives no warning.

West of Koro Levu, 40 miles westward of Suva, there is a marked change both in the character of the country and the climate. The hills, being considerably lower and more isolated, there is scarcely any rainfall, and the thick forests give place to grass and widely scattered screw pine trees.

From Suva to Navua River the general direction of the coast is southwesterly. An iregular chain of reefs lies parallel to the coast, forming four prominent elbows, two of which are three miles from the nearest part of the shore.

Vessels can enter and anchor within either of the passages, but the best harbor is Nai Toni Toni, which is easy of ingress or egress.

After passing Rama (Thumb Peak) the most conspicuous landmark along this portion of the coast is Delai Mau, the highest peak of a short range, 11 miles 257° of Suva. It is conical in form, of a dark color, covered with trees, and 620 feet high.

Namuka Island, situated 3 miles southwestward of the entrance of Suva Harbor, and inside the shore reef, is small and covered with trees.

Namuka Passage.—A short distance southwest of Namuka Island is Namuka or Torch Passage, having deep water, and leading to Namuka Harbor. A small river empties into the harbor at the head of which there is a village and sawmill under the superintendence of an European.

Mount Rama is a good mark for approaching the entrance bearing 340°. To enter, bring Wrights house in line with the eastern peak of the second saddle eastward of Mount Rama, bearing 345°, which leads in the fairway of the channel, westward of center reef, and to the anchorage in about 16 fathoms. There is but little current in the harbor.

Vei Vatuloa.—The native town Vei Vatuloa is the seaport of the Namosi district, and is situated opposite to the passage of that name. There is good anchorage at Vei Vatuloa.

Nanggara Passage, between Vatuloa and Namuka, apparently leads to good anchorage.

Nai toni toni.—Tongoro Passage is ¾ mile wide and is deep; it leads to the anchorage of Nai toni toni. The best anchorage is inside the Western Reef in 6 fathoms.

An iron beacon with round top stands near the southeast corner of the reef on the east side of this passage.

A black buoy marks a small shoal 200 yards from the north or inner extreme of Western Reef, and a 4-fathom shoal extends 300 yards eastward of the northeast extreme of Western Reef.

There is a patch in the anchorage, marked by a beacon, about 670 yards 257° of the north point of the reef. A beacon also marks the reef on the west side of the anchorage. At the edge of the 3-fathom curve line there is a coral patch with less than 6 feet over it.

This anchorage is used by vessels loading from Navua sugar mills, the punts crossing Naitata Flats at half tide.

Navua Roads is the name given to the anchorage formed by the deposit from Navua River. In westerly winds good shelter for small vessels can be obtained westward of the river under the lee of the Rovondrau Reefs in 4 fathoms, mud.

Navua River is navigable for boats from 4 to 5 miles from its mouth. Above Thalia plantation, and before coming to the junction with the Deumba, are rapids, over which canoes only can pass. These latter can be poled up to within a few miles of Namosi town, which is situated under the mountain of that name.

Rovondrau Bay.—Two miles westward of Navua River is Rovondrau Bay, where there is good anchorage in moderate depths, well protected by Rovondrau Reefs from the prevailing southeast winds. Vessels anchor to load sugar northward of the Sand Cay situated 5 miles 122° from Sharks Fin Hill.

Duemba River.—Northeastward of the anchorage in Rovondrau Bay is the mouth of Duemba River, a tidal stream, which joins the Navua 4 or 5 miles from the mouth.

Coral cay.—Rovondrau Reefs terminate 670 yards southwest of a cay of coral grit which stands 1 foot above high water and is conspicuous in bright weather. An iron beacon with a triangular topmark stands on the southwest extreme of Rovondrau Reefs.

Mbengha Passage, between Mbengha Island Reefs and the south coast of Vitu Levu, is 10 miles long, and has for its limits on the south side Pratt Reefs, Pearl Rock, Caesar Rocks, and Nisithi Rocks; and on the north side Naitata Flats, Rovondrau Reefs, Combe, Lake, and Shark Reefs, and Serua Reef. Between Shark Reef and Caesar Rocks the passage is but little over 1 mile wide, the depth mid-channel being about 150 fathoms.

When passing through the Mbengha Passage the most conspicuous landmarks are Storm Islet, Mbengha, Yanutha, and Bird Islet, on the south side of the passage, Rovondrau Coral Cay, Sharks Fin Hill, and a sand cay on Shark Reef on the northern side.

Tides.—In this passage, with an easterly wind, the tidal stream has been observed setting to the westward with a velocity as follows:

At 5 hours and 4 hours after high water, ¾ knot.

At 2 hours and 5 hours before high water, slight set.

Directions.—If bound through Mbengha Passage from the eastward, pass within 1 mile of Rovondrau Coral Cay Beacon and steer 266°, keeping well over to Shark Reef to insure clearing Caesar Rocks. Caesar Rocks are passed when Shark Reef Cay is in line with Sharks Fin, after which a more southerly course may be steered, if necessary, to clear Serua Reef. A good masthead lookout is, of course, required here, as elsewhere in the vicinity of coral dangers. A glance at the chart will show that vessels should not attempt Mbengha Passage at night.

Combe Reef is a coral reef, awash at low water, and situated 1½ miles 257° of Rovondrau Cay.

Lake Reef, 1½ miles 269° of Combe Reef, is covered at low water and less conspicuous than the latter. Midway between Combe and Lake Reefs, there is a coral patch 300 yards in extent, with 2 fathoms water over it.

Shark Reef, westward of Lake Reef, is 1¼ miles long. The western half of it is awash, but the eastern half is a few feet under water. The sand cay on Shark Reef is 1 foot high.

Serua Reef, which affords protection to Serua Harbor, is 4 miles long and 1½ miles broad and separated from the reef fringing the shore by a narrow channel only navigable by boats.

Serua Harbor is well protected from all winds. Anchorage can be obtained in 16 fathoms, mud, with the south extreme of Serua Islet in line with Hogs Back Point bearing 274° and distant 1,200 yards, taking care to allow swinging room for clearing a rock with 2 fathoms water, which lies nearer to the islet on the same bearing. No supplies can be obtained.

A land breeze is sometimes experienced early in the morning, when there is a lull in the easterly breeze outside.

The entrance to Serua Harbor is about ½ mile long and nearly 400 yards broad in the narrowest part. A spit extends off the outer horn on the west side, having from 2 to 5 fathoms water. The depth in mid-channel is 36 fathoms.

The general direction of the passage is 347° and 167°, and there is often a swell setting into the mouth of it.

Caution.—Those in sailing vessels are cautioned against attempting to leave the port in the trade wind months, with the wind eastward of 77°, or against a flood tide.

Water.—Good water may be obtained from a stream 1¼ miles northwestward of the anchorage at the rate of one boat load at each high tide.

Hogs Back is a wooded hill 2½ miles westward of Serua Harbor. It is 800 feet high and conspicuous from both east and west for many miles. Hogs Back Point is the extremity of the ridge extending down to the sea from the Hogs Back. The fringing reef forms a prominent horn 1 mile southward of this point.

Coast—Aspect.—The landmarks most likely to attract attention along this portion of the coast are Loka Levu, Kongi Peaks, Butoni Hill, Cannibal Hill, and Mount Le Jeune.

The sand hills at the mouth of Sinatoke River are also useful in marking the progress of a vessel along the land.

The reef is of a "fringing" character with frequent boat openings, and varying in distance from the shore from 1 mile to 300 yards. For a distance of 2¼ miles westward of the entrance to Singatoke River, there is no reef. There are no known outlying dangers.

Vuna Niu, Sovi, and Nandronga (Thuvu) are small harbors suitable for steamers, but unsafe for sailing vessels.

The high rounded, double summit of the range of mountains northwestward of Vuna Niu Harbor is called by the natives "Loka Levu," or the "big wave," on account of its undulating appearance. It is covered with trees, and 2,160 feet high. Kongi Peaks, 4½ miles 291° of Loka Levu, are two sharp peaks close together and about the same height of 1,870 feet.

Vuna Niu Harbor (Granby) trends north and south, with an entrance 360 yards broad, and clear of rocks. Inside, there is good anchorage in 7 fathoms; mud, well protected. The western horn of the entrance projects southward ½ mile from the mouth, and there is consequently a confused sea immediately outside the passage. Sailing vessels would find much difficulty in leaving this harbor unless favored by a strong land breeze, which is not of frequent occurrence.

The entrance to Vuna Niu Harbor is 1½ miles 269° Hog's Back Point.

Koro Levu is a small native town with a boat harbor 10 miles 291° of Hog's Back Point.

Climate.—This place may be said to be on the boundary line between the wet and dry climates of Viti Levu.

Sovi Harbor, 17¾ miles 286° of Hog's Back Point, is clear of rocks, and 500 yards broad at the mouth. It is open to the southward and the swell rolls into it at times, making it an insecure anchorage for sailing vessels. Steamers can drop anchor in 7 fathoms, sand. There is good landing for boats on the eastern side of the harbor, near a sandy point.

Singatoke River.—The entrance to Singatoke River is at the east end of the sand hills, close to the fringing reef, which terminates at an abrupt, black, rocky point, with casuarina trees growing on it. Near the time of high water, boats can enter over Korotonga Reef. When there is much southerly swell, the bar breaks heavily, and boats can not enter. The river is the boundary line between the Serua and

Nandronga districts. It is navigable by boats for some distance from the mouth.

For 2½ miles westward of the entrance there is no protecting coral fringe, and the southerly swell breaks on the beach at times with great violence, throwing up quantities of sand, which is formed by the wind into hillocks, varying in height from 20 to 190 feet.

Cannibal Hill is a well-defined peak, 1,260 feet high situated 5½ miles inland, and covered with grass. Butoni Hill is a triangular peak between Cannibal Hill and the coast. It is 880 feet high and covered with grass.

Nandronga or Thuvu Harbor is 6 miles westward of Singatoke River. The entrance is 350 yards broad, and there is anchorage inside in 5 fathoms, sand.

The harbor is open to the southward, and, therefore, an undesirable anchorage for sailing vessels on account of the heavy swell which often sets into it, though the wind at the time may be blowing from the eastward.

Landing may be effected in almost any weather on Yanutha Island, which is on the east side of the harbor. Between Yanutha Island and the main there is a commodious boat harbor.

Thuvu is the residence of the Roko Tui of the Nandronga district. The only supplies to be obtained are yams.

Tides.—It is high water, full and change, at 6h. 0m.; springs rise from 5 to 6 feet..

Koromba or Pickering Peak is a conspicuous mountain, 3,550 feet high, with a sharp summit, 17 miles 32° of Nandronga Harbor.

Kamba Island is a low coral island, wooded, 80 feet high, situated on the west side of Nandronga Harbor, and connected with the mainland of Viti Levu at low-water spring tides.

VITI LEVU—WEST COAST.

The coast from Kamba Island to Songo, which is an island of much the same character as Kamba, trends westward for about 5 miles and is fringed by reef which extends from 300 yards to 1 mile from the shore; this reef can be passed over by boats at high water.

Na Tandola Harbor.—Songo Island is situated on the southeast side of Na Tandola Harbor, which harbor is formed by a break in the reef 1¼ miles in depth and 1,000 yards broad. The best anchorage is in 4 or 5 fathoms, sand, close to Songo Island, on the north side of which landing can be effected in ordinary weather.

The swell rolls into this harbor, although the prevailing wind is 122°, and coasters prefer the more secure shelter of Likuri to the northward.

The coast from Songo Island trends in a northwest direction for 2 miles to a sandy point, from which it continues north for 1¾ miles to

Tuva River, off the mouth of which is Likuri Harbor. Boats can pass over the reef bordering the coast between Na Tandola and Likuri Harbors, which extends from 1 to 2 miles from the shore.

Likuri Harbor is found by bringing Koromba (Pickering Peak) to bear 60°. When approaching the entrance, which is situated about half-way along the reef between Vatuloa and Uverite Points, the coconut grove on Likuri Island will attract attention, as it stands out in relief against the land.

The harbor, which is formed by the stream from Tuva River, lies in a 66° and a 246° direction, and is 1 mile long by 700 yards broad. It is well sheltered from all winds and easy to leave, but sailing vessels will find entering difficult with the prevailing wind blowing and no attempt should be made to enter under sail against the ebb tide unless the wind be from a commanding quarter.

Likuri Island, halfway between the entrance into Likuri Harbor and Tuva River, is low and sandy, being about 700 yards long by from 100 to 200 yards in breadth and covered with palms, the tops of which are 70 feet above high water. At low water the island is connected with the sandy point 1¾ miles southeastward of it.

Anchorage may be had in Likuri Harbor with Mount Le Jeune in line with the north point of Likuri Island, 600 yards distant from that island, in 3 fathoms, sand and mud.

A mooring buoy has been placed in Likuri Island Anchorage for the use of trading vessels.

Tides.—It is high water, full and change, at Likuri Island at 6h. 30m. Springs rise 4¼ feet. Neaps range 3 feet. The tidal streams run strongly in and out of Tuva River, the ebb being felt the most in the harbor.

Tuva River is a tidal stream navigable for boats for about 5 miles from its mouth.

Wind and weather.—The wind prevails at Likuri from 122° between 5 a. m. and 5 p. m. At night a light breeze generally comes off the land from the northeastward. These breezes are locally reported to blow with regularity throughout the year, except in the months March, April, and September.

The coast from Tuva River to Uverite Point, the western extremity of Viti Levu, takes a northwest direction for a distance of 6½ miles, and consists chiefly of mangrove. A fringing reef extends throughout for 1 or 2 miles from the shore. Near the land there is a passage for boats and small craft, which connects Likuri Harbor with Nandi waters.

Navula Point lies 4 miles northward of Uverite Point. Situated on a stream at the head of the bay between these two points is the native town Momi. Along this part of the coast is a coral fringe, and overlooking Navula Point is Double Hill, with two peaks, the higher of which is 760 feet.

From Navula Point the coast trends northwards for 2 miles, then eastward and forms a bay 7½ miles long and 2½ miles in depth, in which is the southern mouth of Nandi River.

From the southern mouth of Nandi River the coast trends 4° for 3 miles to the south point of Tomba Ko Nandi.

Tomba Ko Nandi is a bay on the west side of Viti Levu, measuring about 5 miles across, north and south, by about 4 miles in depth.

The rivers Vunda, Sambeto, Na Soso, and Nandi, emptying themselves into the bay, are tidal streams, and accessible only by boats.

Outlying islands and barrier reefs afford partial protection to Nandi, through which there are passages available in daylight only. The southernmost of these, Navula Passage, about 16 miles 201° of the south point of Tomba Ko Nandi, is about ½ mile broad and clear of rocks. The prevailing southeast trade wind is very uncertain and baffling between this passage and the anchorage in Tomba Ko Nandi, rendering the approach of sailing vessels tedious.

Iakuilau Island is low and formed of coral and sand. It has a number of palms and other trees on it, making its entire height 60 feet.

Anchorage.—The depths in Tomba Ko Nandi are moderate, shoaling from 11 fathoms in the northwest part to 2½ and 3 fathoms about 1 mile from the shore, in the southeast, the bottom being muddy. Off the mouth of Nandi River, in the southern portion of the bay, are some low islands and detached coral patches, rendering a near approach to the shore hazardous in large sailing vessels.

The best-protected anchoring ground, which, however, is very confined, lies between Iakuilau Island and the delta of Nandi River, in about 4 fathoms, mud, with the eastern extremity of Iakuilau Island bearing 10° distant 400 to 600 yards, and 300 yards distant from the southeast point of Iakuilau Island.

The holding ground throughout Tomba Ko Nandi is excellent, and with the customary precautions it is considered that a well-appointed vessel could with safety ride out a gale, but the southeast trade wind, which is at times deflected here to northwestward, occasionally raises sufficient sea to prevent cargoes being embarked or disembarked in boats and to render landing difficult.

Caution is necessary during the months in which bad weather may be expected (November to April). A vessel of necessity at anchor in Tomba Ko Nandi should be prepared for storms and, if possible, select a well-sheltered position southeastward of Iakuilau Island for anchorage.

Water can not be obtained by means of ships' boats in this bay without difficulty, the river Vunda in the northeast part of the bay being alone available for the purpose, and that at a diseance of 1½ miles from its mouth.

The coast of Tomba Ko Nandi ends at Vunda Point, which lies 5 miles northward of Iakuilau Island. From Vunda Point to Na Korokoro Point the general direction of the coast is northerly and distant 2.7 miles. The entrance to Ndrekiti river lies between the two points, and a narrow coral fringe borders the coast.

The barrier reefs of the west coast of Viti Levu commence at Uverite Point, and extend in a northwest direction for 34 miles. A space of 17 miles then intervenes directly to leeward of Viti Levu, where there is no barrier. Viwa reef, north of this space, is the westernmost danger of the Fiji group.

The only safe passages through the reefs to Nandi for sailing craft are the Navula and Malolo Passages.

Navula Passage is to be found by bringing Mount Evans in line with the northern summit of Double Hill bearing 55°. The channel lies 77° and 257°, is about 1 mile in length, and 1,000 yards wide in the narrowest part, fringed with coral heads on the south side, and having a depth of from 18 to 50 fathoms in the middle. Sailing vessels should not attempt to beat through against the tide.

Steamers bound from Nandi to the eastward might make use of Navula Passage with advantage, as it enables them to make southing in smooth water.

Navula Passage—Leading lights.—From a white beacon tower erected on the beach at Momi Bay, at 3½ miles east-northeastward of Navula Reef lighthouse, is exhibted a fixed red light, elevated 34 feet, and visible 11 miles.

Rear light: From a white beacon tower, erected at 1.1 miles 76° of the front light, is exhibited a fixed white light, elevated 208 feet, and visible 20 miles. These lights in line, bearing 76°, lead through Navula Passage.

Navula Reef is awash at low water, 2¾ miles long by 1¼ broad, situated 2¾ miles westward of Navula Point. Between this reef and Tavarua Island there is a passage 1 mile wide, suitable for small craft, in which, however, are coral heads having upon them from 2 to 3 fathoms water.

Light.—A fixed white light, 42 feet above high water, is shown from the southern end of Navula Reef. The light is shown from a white structure built on black piles.

Malolo Passage leads between the two sandy islands Tavarua and Namotu (Spieden and Waldron). It may be readily found from seaward by bringing Mount Evans to bear 66° and steering on that course until the islands are recognized. The direction of the channel, which is 1,400 yards long by 1,200 yards broad, is northeast and southwest, the depth in the middle being from 13 to 28 fathoms. Sailing vessels would find this a preferable passage to the Navula; but unless they have a commanding breeze it is not prudent to enter against the ebb tide.

After clearing Malolo Passage, Mount Evans should be steered for until Iakuilau Island is seen, when anchorage can be chosen as convenient.

Tavarua Island is 500 yards in diameter, surrounded by a coral reef and covered evenly with trees and bushes, making its entire height 40 feet.

Namotu Island, 300 yards in diameter, is surrounded by a coral reef, and is easily distinguished by its group of coconut trees, the highest of which are about 40 feet.

Wilkes Passage is a narrow channel between Namotu and the Malolo Barrier Reef.

Malolo Barrier Reef trends 314°, is 1½ miles long, and awash at low water. It has two prominent horns in the middle, and the northwest end has numerous rocks scattered to the north of it. The southerly swell breaks with violence on the horns of the reef.

Mamanutha Reefs lie northwestward of Malolo barrier reef, and between them are numerous passages. The southeast Mamanutha Reef is awash at low water, as is also the south end of the next reef to the north of it, but the remainder are sunken dangers, having from 1 to 5 fathoms water on them. Their edges are not well defined and they break only in boisterous weather.

Caution.—Eastward of the meridian of 177° east, between the parallels of Viwa and Monu, a number of banks were found on which the sea only breaks occasionally. This part is considered unsafe navigation for sailing vessels, as the wind is uncertain, calms not unfrequent, and there are no anchorages except at Waia.

Winds.—The prevailing southeast wind, interrupted by the large island Viti Levu, finds its way to this part sometimes as a northeast and sometimes as a south wind, but is not to be relied upon for many hours, and violent gusts from off the land are occasionally experienced at night.

Viwa Island is about 7 feet high and is not always distinguishable at night. On the south point of its reef there is a heavy break at all times.

Caution.—The British naval vessel *Torch* reported (1904) that the island of Viwa and reefs attached were charted inaccurately and should be given a wide berth.

Tartar Reef is composed of coral, a few feet below low water, lying in a north by west and south by east direction, 2½ miles in length by 1 mile in breadth. Its north point is 18¼ miles 314° from the summit of Malolo Island.

In a line between Tartar Reef and the south point of Viwa Reef there are no known dangers. Coral banks, however, exist, having from 9 to 25 fathoms of water upon them.

Dangers.—The natives of Waia state that several reefs exist between Viwa and Waia; also between Viwa and Na Vandra Island, which only break in strong gales from the westward.

Nandi Waters, the name given to the space inside the barrier reefs southward of Vunda Point, has fewer coral reefs than the northern part, owing probably to the fresh water of Nandi River flowing into it. Immediately between the Malolo and Navula Passages and Nandi the bottom is fairly even (from 10 to 20 fathoms) and affords good holding ground in mud.

Itai, Lovuka, Kandavu, Navini, and Malamala are small sandy islands covered with bushes and trees and situated in the Nandi Waters. There are also several sand cays.

When approaching Nandi from outside the group, whether from the north or the south, those in sailing vessels should choose either the Navula or Malolo Passages. Entering by either of these channels during daylight they are at once in good anchoring ground, if prevented by baffling winds from reaching Tomba Ko Nandi before dark.

Curacoa Rock is a coral shoal about 100 yards in extent, with a depth of 1½ fathoms at low-water spring tides near its center; it lies in the fairway of Nandi Waters, with the center of Iakuilau Islet bearing 80°, and sand cay 317°, distant 1¼ miles. This danger can only be indistinctly seen under favorable conditions even from aloft.

Malolo Islands, west side of Nandi Waters, consist of Malolo, Malolo lai lai, Ngualito Mathiu, Wadingi, and Vatu Mbulo. The last three are mere rocks. Malolo Island only is inhabited. It has a conspicuous peak in the center, 750 feet high, is of a light color, covered with grass, and has two villages.

Mamanutha Islands (Hudson Islands), 13 in number, are divided into two groups, known by the natives as Mamanutha i thake and Mamanutha i ra, or the windward and leeward Mamanuthas. Mamanutha i thake consist of Mana, Matamanoa, Nautanivono, Tavua, Mondriki, Monu, Yanuya, and Tokoriki. Of these the highest and most singular in appearance is Monu, which has a remarkable thumb peak to the westward of and nearly as high as its summit, 730 feet high.

Mamanutha Rocks are situated upon a reef between the two groups of islands; the highest is 3 feet above high water.

Mamanutha i ra Islands consist of Yavurimba, Kandomo, Vanua Levu, Na Vandra, and Eori. The highest is Na Vandra, which has a well-defined summit 420 feet above high water. The same coral reef surrounds this island, Vanua Levu, and a large rock named Naniuka leile.

Camel Rock, situated on a reef 314°, about 1 mile from Kandomo, is conspicuous and 15 feet in height, taking its name from its resemblance to a camel in a recumbent position.

Vomo Island is volcanic, flat topped, 380 feet high, 9¾ miles 83° of Yavurimba. It is of a light color, being covered with grass, and surrounded by a coral reef, on the northwest end of which is a rock 200 feet high, named Vomo lai lai.

White Rock is a small islet 7 miles 347° from Vomo. It is covered with guano and 40 feet high.

Yasawa Group.—Off the northwest coast of Viti Levu, and distant from it 30 miles, is a chain of volcanic islands occupying a space of about 50 miles in a 32° and 212° direction, named the Yasawa Group. The southernmost of this chain are the islands Waia, Waia lai lai, and Kowata, which by themselves form a small group.

Waia Island is 3½ miles long by 2¾ miles broad, the general direction of both its eastern and western coasts being about north and south. It has several singularly sharp peaks, the highest, which is toward the northeast end of the island, being 1,870 feet above the sea. A rugged, well-defined mountain overlooks the southwest cape. It is 1,660 feet high, and perpendicular on its western face. The southwest cape is terminated by a quoin-shaped hill, 270 feet high

Situated 1,200 yards from the northeast cape of the island is a rocky islet 40 feet high, with a few bushes on its summit, named Windy Rock. Waia is inhabited.

Alacrity Bay, which is on the south side of the island, is fairly protected from all points but south, from which direction a considerable swell rolls into the bay at times.

Entering Alacrity Bay, keep the southwest high peak of Waia bearing 353° until the summit of Waia lai lai bears 111°, when steer for the black rocks on the shore reef at the head of the bay, keeping clear of a 2-fathom patch on the port hand, and anchor in 14 fathoms, sand and mud, off Yalombi Village, left extremity of Waia lai lai and the right extremity of Waia being in line, and the two islands appearing as one. No water or supplies are to be obtained.

Caution.—Sailing vessels entering Alacrity Bay with northeast winds should reduce sail on rounding Reef-topsail Point, as heavy squalls sweep down the gullies and between the islands.

Watering Bay is situated on the north side of the island. It is 2 miles long and 1 mile in depth. At high tide good water can be easily obtained from a stream at the head of the bay.

Two coral heads, with 12 and 15 feet of water on them, lie just outside the bay, and there are many shallow coral banks between Waia and Viwa which have not been examined.

Entering Watering Bay, run in until Windy Rock is lost sight of behind the northeast cape of Waia, and the northwest cape bears 302°, or summit of Waia bears 77°, when anchorage can be had in 20 fathoms, mud. In this berth a vessel would not feel the swell raised by northeast winds, and be in a good position for weighing.

Waia lai lai has one remarkable thumb peak, which is, by a few feet, the highest point of the island. It overlooks the southern coast and is 1,160 feet high. Waia lai lai is connected with Waia by a coral reef, which can be crossed by boats at high water.

Kowata summit is 570 feet above the sea. A channel 550 yards wide separates this island from Waia lai lai. The south cape of Kowata has been named Reef-topsail Point.

Yasawa Islands extend in a northeast by north and opposite direction for 45 miles to the northwestward of the northwest coast of Viti Levu. They are 16 in number, with numerous small islets and rocks. Naviti is the largest of the group, next to which, in point of size, comes Yasawa, from which the islands have been named. Coral fringing reef generally surrounds the various Yasawa Islands, extending northeast by north from the northernmost for about 6 miles. Between these islands and the northwest coast of Viti Levu the inclosed space is much encumbered with coral patches.

Naviti Island (lat. 17° 06′ S., long. 177° 15′ E.), northward of Waia, is about 740 feet high, 8 miles in length in a northeast by north and opposite direction, by 3 miles in breadth. A bight indents its north and south sides, but no anchorage was found.

Although there is little level ground for cultivation on Naviti Island, there are, nevertheless, several villages.

From Naviti Island to Waia, a distance of about 8 miles, the cluster of small islands continues with the same southwest by south trend. To four of these the names Eld, Fox, Agate, and Sinclair Islands were given.

Ethel Reefs, which cover at high water, are situated from 5 to 9 miles westward of the central part of the Yasawa Group, and taking the form of narrow barrier reefs, are two in number, each about 9 miles in length; they take a direction, on the whole, about northeast by north, or parallel to the Yasawa Islands.

Wreck.—The wreck of the steamer *Kilburn* lies sunk on the eastern side of Ethel Reefs at about 2 miles from the northern end.

Tidal stream.—During the flood the stream in the vicinity of Ethel Reefs is reported to set to the southeastward with a velocity of 2 knots.

Porpoise Shoal is charted about 2 miles distant in a westerly direction from the southwest extremity of the southern of the Ethel Reefs.

Yasawa Island, the northernmost large island of the Yasawa Group, is narrow and about 10 miles in length, northeast by north and southwest by south; toward its southern end it rises to a peak about 780 feet high, named Tau thake, the ascent to which lies over a fertile plain, 1 mile in extent, having a village upon it.

Southward of Yasawa Island and between that island and Naviti Island, a distance of about 14 miles, are the islands of Nathoulla, Jabeia, Matathoni Levu, Nanuia, and Agata. All of these are hilly and have extensive fringing coral reefs. Passages appear to exist between them which have not yet been surveyed.

Emmons Bay, in the northwest part of Yasawa Island, is formed between the north coast of Yasawa Island and the reef extending southwestward from the small islet Asaua.

Yasawa i lau Bay is formed by an indentation on the east side of the reefs fringing the southeast .coast of Yasawa Island and the north coast of Nathoulla Island. Detached and situated in the eastern part of Yasawa i lau Bay is a castle-shaped rock with but little vegetation on it.

Anchorage may be found in the small bight in the southwest part of Yasawa Island, well protected, except from the northwestward, by the coral reef joining two small islets, which are here situated.

Round Island Passage, about 8 miles broad, is the dividing channel between the extremity of the reef extending northeast by north from the Yasawa Group and the western ending of the extensive Barrier Reef northward of Round Island (Alewa Kalou) and extending for 90 miles toward the center of the north coast of Vanua Levu; this passage has not yet been sounded out, 5 fathoms are shown nearly mid-channel, so that it is needful to use great caution should it be necessary to make use of it.

Alewa Kalou or Round Island (lat. 16° 40′ S., long. 177° 46′ E.), within Round Island Passage, and 32 miles 286° from Yendua Island, attains a height of about 500 feet, the sides are steep cliffs, the summit covered with grass and stunted bushes. It appeared inaccessible from the British schooner *Renard*, which vessel anchored on a coral ledge off the southwest end of the island in 5 fathoms, about 100 yards from the cliffs. Heavy squalls sweep around the island occasionally, rendering the vicinity dangerous.

Coral patches are said to extend to the southeastward to Yendua Island.

ROUTE INSIDE THE BARRIER REEF OFF THE WEST, NORTH, AND NORTHEAST COASTS OF VITI LEVU.

General remarks.—The route inside the barrier reef which surrounds the greater part of Viti Levu may be safely taken in clear weather when the sun is well above the horizon and astern of the vessel, which should be conned from the masthead. There are but few sharp turnings and none that offer any difficulty to a handy steamer.

It may be entered from the southwestward either by Navula or Malolo Passages, thence for Tomba Ko Nandi, and then following the pecked line on the chart.

It is difficult to obtain the services of a pilot who has a thorough knowledge of the whole coast; there are many who know the pilotage of parts of the coasts, but as they are accustomed to small vessels only and navigate entirely by the eye, too much confidence should not be placed in their abilities. The native pilots can generally point out with accuracy the shoals. The Lasakau, or fishermen, of Mbau are those who possess the greatest amount of general knowledge, but it will be necessary to take a new pilot for each part of the coast.

Vunda Point, the north extreme of Tomba Ko Nandi is a low sandy point situated 3 miles southward of Na Koro Koro Point.

Ndreketi River, between the two points, appears from seaward to be a large stream, but on ascending it quickly contracts and terminates in a small creek of no importance.

Na Koro Koro Point is the northwest extremity of Viti Levu; it is from 40 to 60 feet high, thickly wooded, and has a small fringing reef. For a considerable distance inland the country is low, covered with grass and screw pines.

Light.—The light near Koro Koro Point is fixed white, elevated 42 feet above high water, and is visible 10 miles; it stands on the western extremity of the reef 1¼ miles south of the point.

The following islets and reefs border the fairway: Tivoa Sand Cay, 18 feet above water, is situated on the eastern side of a coral reef at 2½ miles 325° of Na Koro Koro; Pasco Cay, northeastward of it, is 10 feet in height, and there are numerous patches in the neighborhood.

Savala Islet, at 3¼ miles northward of Na Koro Koro Point, is sandy, covered with bushes, and has a coconut tree in the center.

Vio Islet is covered with mangroves, with a few palms in the center, making the height about 55 feet; it is situated on a small reef separated from the coast by a narrow channel. There is excellent anchorage in from 7 to 10 fathoms, mud, anywhere between Na Moti and Mbekana Island, northeastward of Vio.

Light.—From a white iron framework, erected on the northern end of this islet, is exhibited a fixed green light, elevated 25 feet, and visible 5 miles.

Mbekana Island is also covered with mangroves and has a few coconut trees; it has a fringing reef marked on its northwest extreme by a small white buoy.

Yawalau Island is 29 feet high to the tops of the trees and lies ¾ mile northward of Nai Vaka Point; the surrounding reef dries at low water.

Nai Vaka Point is 4 miles 224° of Thilau Point. It is a mangrove swamp with a small sandy beach. At 1 mile to the southward of it there is a high conspicuous clump of palm trees.

Eva Cay, at 1.3 miles westward of Thilau Point, is a narrow ridge of coral grit, 3 feet in height, situated on a small reef, which is awash at low water, and has deep water around.

Thilau Point is a well-defined headland, with a conspicuous ridge of hills, extending to Ba Peak. It is fronted by a narrow shore reef with a considerable number of rocks on the western edge.

Melevu Islet is low, sandy, and 4 feet above water, but is 48 feet high to the tops of the trees. A very small patch of coral, with 3 feet water over it, lies 270 yards southwestward of the islet.

Malevu reef extends 270 yards northeastward of the islet and dries at low water; a white buoy marks the western corner of the reef. Vessels should not navigate southward of Malevu as there are many sunken dangers in the passage.

Shoal.—A shoal of 2 fathoms is reported to be situated 1 mile westward of this islet and close westward of the track recommended.

Hood Reef lies 4 miles 55° of Malevu, is awash at low water springs, and a small white buoy marks its northern edge. Kelly Reefs lie 1 mile 235° of Hood Reef, and between it and Malevu Reef there are sunken reefs, and westward there are many patches.

Ngana Point is a low point of mud and sand on the western side of Ba River with extensive mangrove swamps at the back.

Ba River is one of the largest rivers in Fiji and is navigable for boats 10 to 11 miles at half tide, and for small coasting vessels, not drawing more than 6 feet water, for 9 miles at high water. The entrance through the extensive mud flats off the coast is winding and 2 miles long; it is well beaconed, and at low water there is not more than 2 feet in places, and there are constant changes.

Ba Roads are off the entrance to the river, where a small buoy is moored on the edge of the 3 fathoms curve. Good anchorage can be obtained in any required depth over soft mud.

Communication.—Three to four steamers of 1,500 to 2,500 tons visit Ba Roads each month to ship sugar or bring coal to the sugar refineries.

Tavutha Reef lies close off the coast of Vatia Headland and is 5 miles in length. Close inside the southeast edge there are numerous sand patches that dry from 1 to 2 feet at low water. At and near the southern end there are some mangroves 10 to 15 feet high, and a small coral patch, which dries at low water, lies close off the south point of this reef, which should not be approached nearer than 400 yards.

Vatia Headland is high, rugged, and partly wooded, with a rounded summit 1,313 feet high. Vatia lai lai is 455 feet high and situated 200 yards northward of Vatia Point, and joined by a reef, awash at low water. Tavua River is only navigable by boats for a distance of 2 to 3 miles.

Nandi Mbulu River, 9 miles 122° of Vatia Point, is shallow and navigable for boats about 1½ miles.

Sali-Sali Reef lies ¾ mile northward of Vatia lai lai. It is triangular in shape, 4 miles east and west, and dries on the outer edges at low water. Manava is a small sand cay on its western end.

Davy Rock is a small coral patch, awash at low water, lying ½ mile south of the southern point of Sali-Sali Reef. All navigation should be to the northward of Davy Rock.

Manava Passage, from the northwestward, can be recommended; it is 1,200 yards wide and has deep water in mid-channel. The west point of Sali-Sali Reef should be avoided as there are groups of rocks extending 500 yards from it. This entrance to the inner route should be navigated on a bearing of the northeast part of Vatia lai lai.

Tides.—It is high water at Manava sand cay, full and change, at 6h. 2m.; springs rise 6¼ feet, neaps 3 to 4 feet.

There is little or no stream felt inside the reefs except in the passages leading to seaward.

Na Tombu Ndrauivi Passage is broad and deep, but at the entrance there are two extensive sunken spits extending off the corners of the reefs on either side, contracting the channel to 600 yards, rendering navigation dangerous. This entrance is not recommended.

Ve Ndrala Reef forms the western side of Nuku rau vula Passage and extends 7 miles to the westward. The southern edge is steep-to and dries 1½ feet at low water. The northern edge is very uneven, and many small patches lie close off it.

Nuku rau vula Passage, between Ve Ndrala and Thakau moi Reefs and 3 miles 302° of Mathuata, lies north and south, is 1½ miles long and 670 yards wide, with deep water. There is a small sandy cay that is awash at high water and is a mark for the channel in calm weather. There is but little break on the reef at any time.

Mathuata is 400 feet high, covered with grass, and partly wooded. It is situated ¾ mile off the coast and joined to the mainland by a reef that is awash at low water. There is good anchorage in the bight in this reef for small craft; larger vessels anchor westward of the island in from 13 to 16 fathoms, mud.

Tides.—It is high water, full and change, at Mathuata Island at 6h. 15m.; springs rise 4 feet 6 inches, neaps about 3 feet 6 inches.

Nathilau Point is 1 mile 235° of Mathuata. It is sharp and well defined, with several grassy hills, 300 feet high.

Tovu and Tovu lai lai Islands are situated on the same reef; the former is 250 feet high and is covered with grass and screw pines.

The passage between Mathuata and Tovu Islands is 1,200 yards broad, the depth being 9 fathoms. The reef on which Tovu Islands are situated is separated from the shore reef by a narrow passage, the soundings in which vary from 7 to 13 fathoms, but the track recommended is northward of the islands.

Malaki Island, 755 feet high, covered with grass and casuarina trees, is surrounded by fringing reef, which extends 500 yards offshore on the north side; on the southwest side there is but little reef. Good anchorage will be found in 12 fathoms, mud, close to the shore.

There is a clear ship passage between Malaki Island and Thakau vatu latha, the large reef immediately to the north of it, but the space between the island and the mainland is thickly strewn with shoals and rocks and is only adapted for boats.

Malaki Pass.—The least water found was 18 fathoms. This entrance is much contracted by a coral patch and a cluster of sunken rocks lying off the west end of Thakau Tanau. It, however, affords a fair channel for those wishing to proceed to sea to the northward with the usual trade wind, but no vessel should attempt to beat through, as, in addition to the dangers above mentioned, the tidal streams in it are strong and irregular. The summit of Mount Siwano in line with Malaki Summit leads from seaward up to the entrance.

Directions.—When proceeding along this part of the coast of Viti Levu pass on the north side of Mathuata, Tovu, and Malaki Islands, keeping midway between the fringing reefs surrounding the islands and the barrier reefs, the only known dangers being a 1½-fathom shoal and a coral patch, the former 1½ miles 263° and the latter 2 miles 246° from the west point of Malaki Island. Vessels should follow the route recommended as shown on the chart.

The bottom in some places, especially in the vicinity of Tovu and Mathuata Islands, consists of light-colored mud; this being stirred up, presumably by under currents, causes light patches to appear which have all the appearance of shoal water. (Inner route continued on succeeding pages.)

Charybdis Reef (lat. 17° 10′ S., long. 178° 08′ E.) lies seaward of the Barrier Reef; it is just awash, of circular form, 5 miles in diameter, inclosing a lagoon, the average depth of which is 20 fathoms, with numerous rocks and shoals scattered about in it. The eastern portion of this important danger consists of solid reef with deep water close-to; the remaining portion is broken up into sunken rocks and patches, in the vicinity of which are strong tide rips. On the north edge of Charybdis Reef are some conspicuous bowlders, uncovered at half tide, and on the south end of the solid portion of the reef there is a bowlder which dries 4 feet. About 7 miles westward of Charybdis Reef, some reefs were seen with rocks dry on them, but the space between them and Charybdis Reef appeared clear.

Tidal streams.—The tides in the space between Charybdis Reef and the barrier reef westward of Yendua Island run very strongly and irregularly in direction.

Inner route continued.—**Vole Vole Point,** the extreme north point of Viti Levu, is low and fringed with mangroves, with a ringing reef off it.

Nananu Islands, named, respectively, Nananu i ra and Nananu i thake, are 230 feet high; they are covered with grass and bushes and have in some places been planted with coconut trees. The islands are connected by a reef, over which boats can pass at half tide. A small island named Yanutha, 60 feet high, is situated on the reef between them.

Mbua Islet, 35 feet high, is situated on the shore reef at the southeast end of Nananu i thake; boats can pass between them at half tide.

Anchorage.—That recommended is in 9 fathoms, situated between the two Nananu Islands, and just to the southward of Yanutha Islet, the bottom is blue mud, and the holding ground very good.

Caution.—The whole of the ground in the vicinity of these islands is thickly studded with extensive reefs and sunken dangers; the navigation is consequently dangerous, and should not be attempted without a commanding breeze, and the sun in a favorable position. The reef passages between the large reef eastward of Nananu i thake and the mainland can be clearly distinguished on a fine day, and used with safety by steamers; they are, however, intricate, and sailing vessels should pass outside the Nananu Islands and the large reef, keeping a good lookout for the rocks off its north end.

The coast eastward from Vole Vole Point consists principally of mangrove with a few rocky points and sandy beaches, the fringing reef extending from 400 to 1,000 yards off it. Immediately opposite the southwest end of Nananu i thake, there is a deep bay accessible to small craft; it has, however, several rocks in the entrance which must be looked out for. Five miles to the southeastward is the entrance to Viti Levu Bay.

Viti Levu Bay is about 3 miles in length, 2¼ miles wide, and has some shoals lying off the shore reef on the western side. The shores consist of sandy and stony beaches with rocky points and mangroves between them, and coral and mud flats extend off them. The depth in the center of the bay is 12 fathoms, shoaling gradually to the head where the entrance to Ruke Ruke River is situated.

There are several villages on the shores of Viti Levu Bay from which native supplies can be obtained, this being the principal yam-growing district in the neighborhood.

Rock.—A rock of 2 feet is reported to be situated near the center of this bay, at 1¾ miles northeastward of Koro tiki Hill.

Ruke Ruke River.—The bar at the mouth prevents anything but small boats passing into this river; inside, the depth is 6 feet.

Koro tiki is a remarkable, dark, thumb-shaped hill, about 650 feet high, situated in the southwest corner of the bay, and has a village on it; this hill (which is conspicuous from seaward), on a 212° bearing, leads through the clearest part of the barrier reef.

Ngilongilo Head is a conspicuous dark headland, 405 feet in height, situated 3½ miles eastward of Viti Levu Bay. The coast to the southeastward, betwen Ngilongilo Head and Tanavuso Point, is broken up into several small bays and inlets, all of which afford good anchorage on a muddy bottom.

Tandruku Islet, 35 feet high, is situated on the fringing reef off a low rocky point.

Tanavuso Point is the extreme of a spur from Tova Peak. The shore reef extends 800 yards off to the northward (and has several sharp stones on it). Boats should not attempt to cross it, and vessels should give it a wide berth.

There is good anchorage on the west side of Tanavuso Point in 9 fathoms, just westward of a small shoal lying off the shore reef.

Reefs.—Between Nananu Islands to the westward and Tanavuso Point, the barrier reefs consist of two irregular lines of coral reefs and sunken rocks, the nature of the bottom between the coast and the inner line being mud; and that between the two lines of reef, coral. It is recommended to keep to the inshore passage.

Vatu i ra Islet and reefs.—Vatu i ra Islet, 100 feet high, consists of two rocky hummocks surrounded by a slight fringing reef. It is situated in the northern part of the Vatu i ra Lagoon, which is 14 miles in length in a north and south direction, and has an average breadth of 3 miles. The average depth of the lagoon is 27 fathoms in the northern portion, and 22 fathoms in the southern, and there are many patches and sunken rocks in it; there are several passages into the lagoon through which the tide runs strongly.

Anchorage.—The British surveying schooner *Alacrity* anchored close off the southwest side of the islet in 22 fathoms, and found the tides there very irregular, both as regard strength and direction.

Vatu i ra Channel, which separates Vatu i ra Lagoon from Vanua Levu Barrier Reef, is nearly 3½ miles across in the narrowest part; no bottom could be obtained with 205 fathoms of line.

There are two small reefs bodering on the channel, one lying 3¾ miles 122° from Vatua i ra summit, the other 1¾ miles off the Vanua Levu Barrier Reef, and bearing from Vatua i ra Summit 94° distant 7¼ miles.

Thakau Ndavui is a circular reef 1 mile in diameter and situated 4 miles eastward of the south end of Vatu i ra Lagoon.

Moon Reef is nearly 1 mile in diameter and separated from the south end of Vatu i ra Lagoon by a channel 1,000 yards broad, in which no bottom could be obtained at 150 fathoms.

Coast—Aspect.—Tova Peak is 2,095 feet high, fang shaped when viewed from the eastward or westward, but sharp from the northward, has its sides wooded and the summit rocky. There is a conspicuous thumb-shaped spur on the northern slope named Tova lai lai. From Tova Peak a long ridge of hills extends to the westward and slopes down gradually to the coast. Between Tanavuso Point and Tai Levu Point the coast is sandy, with coral and mud flats extending from 400 to 600 yards off it; there are several rivers and streams on this portion of the coast. Just westward of Tai Levu Point there are some low yellow cliffs.

Water can be obtained on this coast wherever there is a village situated, but the shore reef prevents the approach of boats except at high water.

Tai Levu Point is low and sandy, with a grove of coconut trees on it; on the rising ground behind the point is a white house, owned by an European who has a cattle station here.

Ngoma Island is 120 feet high and well cultivated. The northwest end terminates in a bluff 30 feet high. The island is surrounded by fringing reef, which extends 400 yards off the northwest end, and has some rocks 3 feet high on the edge.

There is fair anchorage, in 7 fathoms, southwest of the bluff on Ngoma Island.

Tides.—The tides in the channel between Tai Levu Point and Ngoma Island run with considerable strength, probably about 4 knots at springs, the ebb tide being stronger and setting to the westward. It is high water, full and change, at Ngoma Island at 6h. 10m. Springs rise 4 feet 6 inches.

The east coast of Viti Levu, between Tai Levu Point and Yerata Point, is fringed with mangroves and coral reefs, and mud flats extend off it.

Nukulevu Island is sandy and covered with coconut trees 30 feet high.

Namina.—The magistrate of the district resides at Namina village.

Yerata (or Verata) Point is known as Na Uthuna Vanua. There is a Roman Catholic mission station and church on this point. The space between this portion of the east coast and Ovalau Island is thickly strewn with coral reefs and sunken rocks, the navigation amongst which is dangerous; a good masthead lookout and the sun in a favorable position will be the best guides.

Winds and weather.—Between the Nananu Islands and Tai Levu Point a light land breeze occurs early in the morning, the general direction of the trade wind is, however, southeast by east, and it commences between 8h. and 9h. a. m. At the Nananu Islands the trade apears to attain greater strength than is the case further to the eastward, and it frequently freshens considerably, force 5 to 7, and becomes very squally with rain, generally subsiding toward sunset. A westerly wind is occasionally experienced with fine weather, rarely lasting, however, more than one day. Winds from the northwestward are accompanied by rain.

CHAPTER VIII.

FIJI ISLANDS—LAU OR EASTERN GROUP.

Koro Island—General remarks.—Koro Island, of volcanic origin, situated 36 miles northeastward from Levuka, lies north and south, and is 10 miles long and 5 miles broad at the northern end. The island tapers to the southward and terminates in a well-marked promontory named Alldin Point.

The mountains of Koro are densely wooded, but the summits are badly defined. One ridge traverses the island from Nathomaki Point to Alldin Point, the highest point of the ridge, which is near the center of the island, being 1,840 feet above the sea. Clouds cover the mountains during strong trade winds.

Coral reef, mostly of the fringing character, surrounds the island, except for a distance of 4 miles on the west coast. In no place does the reef lie more than 1½ miles from the shore.

Off Nola Point, on the northwest of the island, are some dangerous reefs, upon which the sea seldom breaks. Nola Point has a conspicuous mound over it 240 feet above the sea.

There are three anchorages in Koro, namely, Stone-axe Roads, Tulane Cove, and Nangaindamu Harbor, and there are several boat harbors on the east coast.

The island is rich in coconuts. Copra, cotton, maize, and arrowroot are exported.

Caution.—Sailing vessels passing Koro at night must keep at least 2½ miles from the north shore of the island to avoid Smoothwater Reefs.

Stone-axe Roads, on the north coast of Koro, are protected from the south and southeast by the island, from the east by the Vatu Leile Reefs, and from the northwest and west by Smoothwater Reefs. From the north the only projection is a line of sunken rocks, which would not effectually check the sea raised by a gale from that direction.

The entrance, which is 900 yards wide, may be found by bringing Nola Point to bear 212°. The sunken rocks on the east side of the entrance are difficult to see unless the light is good. Anchorage is good off Nambuna Village in from 9 to 15 fathoms, sand, but there is more shelter and better landing off Nandawa and Matana, 1 mile to the westward.

Smoothwater Reefs are awash at low water, but have two good boat passages through them; there is also a boat passage close to Nola Point.

Supplies of beef, poultry, yams, taro, kumalas, and oranges can be obtained on the north coast of Koro. Water can be shipped at Nambuna.

Tulne Cove, on the west coast, 1 mile southeastward of Nola Point, is a small harbor well protected from all directions but northwest by north, and has a somewhat limited accommodation in good anchorage of 14 fathoms, sand and coral.

On the reef, which forms the south projection of the cove, there is a sand cay 1 foot above high water, and also (at the extreme horn) a rock 3 feet high; the west projection of the cove is a line of coral heads, stretching 800 yards 336° from the sand cay.

Alldin Point.—South of Alldin Point, the south extreme of the island, there is a conspicuous horn of coral reef, which extends ¾ mile from the shore. The shore reef extends about the same distance off, as far northeastward as Nangaindamu, and beyond it to a less distance.

Light.—From a white tower, 76 feet high, erected on this point is exhibited, from an elevation of 194 feet, and visible 17 miles, a group flashing white light.

For details see Light List.

Nangaindamu Harbor is on the east coast of Koro, 5 miles south of Nathomaki Point, and takes its name from a village situated at its head. It has two entrances, named North and South Passages, suitable for steamers or small sailing vessels.

There are several coral heads in the harbor not easily seen on account of the muddy water discharged from the streams.

North Passage is long and winding, 60 yards broad, and 8 fathoms deep in the narrowest part; its general direction is north and south.

South Passage is 200 yards wide and has from 21 to 27 fathoms in midchannel; dangerous spits extend off either horn of the entrance, and from inside of the south horn a line of sunken rocks extend in a northwesterly direction for 600 yards. Therefore, a 325° course must be steered on first entering the harbor.

Anchorage in Nangaindamu harbor can be found in from 4 to 8 fathoms, 600 to 1,000 yards southeastward of Nangaindamu village, or in 12 to 20 fathoms under the lee of the large detached reef which forms the easterly protection of the harbor.

A coral spit extends off Nathomaki Point, the northeast extreme of the island, for 1 mile in a northeasterly direction.

Wakaya Island and Lagoon.—Wakaya Island, situated 9 miles 89° from Levuka, is 4.3 miles long northwest and southeast, very narrow at the southern part, and the highest peak is 595 feet above the sea. It is surrounded by a coral reef which fringes the west coast, and on the east side forms an extensive barrier, the south horn of which is 3.3 miles 134° from the south point of the island. In the lagoon there is anchorage in moderate depths over a sand and coral bottom.

Small craft pass through the lagoon, but the passages on the east side of the barrier are not adapted for anything larger.

Light.—A fixed white light has been established on the southern extremity of Wakaya Reef. It is shown from a white hexagonal tower, 70 feet high, erected on black piles, the light being 75 feet above high water and visible 14 miles.

For details see Light List.

Entrances.—North of Wakaya there are two ship passages, the Daveta ni kai drai imba being the best for large vessels. This passage, with from 10 to 20 fathoms of water, is about 1 mile north of the island and is 500 yards wide; it can be found by bringing the east point of Wakaya to bear 145°.

Anchorage can be had in from 9 to 14 fathoms, sand and coral, in Nuku Tumbu, at the north end of the island.

Daveta ni kai drai imba—Beacon.—The southwest extreme of the reef on the north side of this passage is marked by a beacon.

Makongai Island and Lagoon.—Makongai Island, of volcanic origin, situated 7½ miles 347° from Wakaya, is 2 miles long by 1½ miles wide, and has two peaks in the center about the same height, or 876 feet. Makon Dranga, ½ mile northwestward of Makongai, is 1 mile long by ½ mile broad.

The lagoon is on the west side of the island, where the barrier is much broken up, allowing the passage of vessels in several places.

Anchorage.—The best anchorage is in Dalithe Bay, northwest side of the island, in from 10 to 14 fathoms, sand and coral.

Vatu Vula is a coral patch off the west side of Makongai Harbor Reef, situated 400 yards westward of the horn of that reef. It is 400 yards in diameter and is always breaking.

Those navigating through Makongai Passage generally pass within ½ mile of this danger, and thus insure giving a wide berth to the southeast horn of Passage Island Reef. Vatu Vula bears 268°, distant 3½ miles from Makongai Summit.

Makongai Passage, a much frequented passage between Vatu Vula and Passage Island Reef, is 2 miles wide, but quickly passed, as the limits of the channel are of small extent.

Tidal streams.—The flood stream sets through Makongai Passage to the southward and the ebb to the northward. The turn of the tidal stream is not regular.

Caution.—When navigating between Levuka and Makongai Passage, give a wide berth to the northeast horn of the Ovalau Barrier Reef, which breaks very lightly, owing to its protected situation, and is consequently difficult to see at night. The horn bears 220° from Vatu Vula, distant 7½ miles.

VANUA LEVU—SOUTH AND SOUTHWEST COASTS.

Aspect.—The south coast of Vanua Levu, which is included between Navukana Promontory and Solevu Point, has a general west by south direction, and a length of 72 miles. Two large bays indent the coast, one of which, Savu Savu Bay, is a capacious harbor, and contains the principal port in Vanua Levu.

The aspect of the land from seaward is mountainous and densely wooded. Several remarkable peaks vary the panorama, their altitudes ranging between 2,000 and 3,000 feet, the most striking being Na Raru, which is 2,420 feet high, and very sharp when seen from the southward.

The lofty island Taviuni, situated opposite the extreme southeast cape of Vanua Levu, is seen from along the coast only in clear weather. In strong trade winds clouds cover its summit, and it can not then be seen farther west than Kulundrusi.

Navukana Promontory, the southeastern cape of Vanua Levu, forms the western side of the narrows of Somo Somo Straits.

Viani Bay is a deep indentation on the west side of Navukana Promontory. There is good anchorage at the northeast corner of this bay off Vatolutolu plantation in 13 fathoms, sand and mud, well protected from all quarters.

Viani Pass.—Viani Bay is easily approached through Viani Pass, a break in the outer reefs 1 mile wide, but having a coral bank in the center, the least water over which is 2 fathoms at low tide.

Inside the barrier reef there is no navigation westward of Mbenau Islet except for boats and small coasting craft.

Wai Ndeleka is a bay about 670 yards in extent ½ mile east of Mbenau Islet. The point which forms the eastern side of Wai Ndeleka separates it from Viani Bay.

Barrier Reef.—**Mbenau Islet** is about 100 yards in diameter and formed of shingle and sand. It is covered with palms and other trees, making its entire height 50 feet.

About 200 yards northeastward of Mbenau Islet is a conspicuous black, rocky point, eastward of which is Mbenau Village.

Boats can pass inside the reef from Ndreknamba to the eastward of Mbenau by a narrow passage close to the south shore of Mbenau; the tidal stream runs swiftly through this passage.

The coast from Mbenau Islet to Naweine Point forms a bay with several islets and rocks in it, and two harbors suitable for large vessels, named Fawn Harbor and Waikava Harbor; also five passages which can be used by very small craft, namely, Naweine, Levuka lai lai, Vunelangi, Kassavu, and Ndreknamba.

The coral reef, chiefly of a fringing character, extends from ½ mile to 2 miles from the shore.

Ndreknamba Passage is 100 yards wide and leads into a lagoon.

In a bight of the coast northeastward of the passage there is a village from which the passage takes its name.

Waikava Harbor is ¾ mile long east and west and from 400 to 1,200 yards broad. On the west side of the harbor there is a small coral island named Thakaundrove, covered with bush and trees, making its entire height 30 feet. A coral reef extends 400 yards eastward of Thakaundrove and at Waikava Vilage, the low-water line of coral, mud, and sand, extends 300 yards outside the high-water line.

Anchorage can be had in Waikava Harbor in from 6 to 14 fathoms, muddy bottom, the best being in from 6 to 9 fathoms with the center of Thakaundrove Islet bearing 235°, distant 600 to 800 yards.

Water can be obtained with facility from a stream 100 yards east of the village.

Waikava Passage, the channel into Waikava Harbor, trends north and south, is 1,600 yards long, 350 yards broad at the mouth, and 250 yards in the narrowest part, which is near the harbor. The depth between the outer horns is 36 fathoms, and between the inner horns 27 fathoms.

Fawn Harbor is 1 mile long east and west and from 200 yards to ¾ mile broad north and south. Good anchorage can be obtained in from 6 to 12 fathoms, muddy bottom, well protected from all directions. This is an admirable harbor for steamers, but sailing vessels are wind bound in strong southeast winds on account of the direction of the first reach of Naikasa Passage, and the difficulty of clearing the lee reef, which trends 217° for 1 mile outside the entrance.

Naikasa Passage is the entrance to Fawn Harbor. It is 200 yards wide, between the outer horns of the entrance reef, and 180 yards at its narrowest part, which is between the inner horns. The depth between the outer horns is 28 fathoms, and between the inner horns 20 fathoms.

The passage is 1,800 yards long and has a bend in the center, making it difficult at times for sailing vessels to take their departure, as the inner reach lies south by east and north by west.

Kassavu Passage, 3½ miles westward of Naikasa Passage, is 80 yards wide, and has 13 fathoms between the outer horns.

Vunelangi Passage, ¾ mile 235° of Kassavu Passage, is 100 yards wide, and has 17 fathoms between the outer horns.

Levuka lai lai Passage, situated 2.3 miles northeastward of Naweine passage, is 80 yards wide at the mouth, and well marked by a flat rock 6 feet high which stands on the western horn of the entrance reef.

Naweine Passage, ¾ mile eastward of Naweine Point, is 80 yards wide, and has a coral head in the center, upon which the sea usually breaks. The passage is in a bight of the reef, and is well marked by a mushroom rock which is 10 feet high, and situated close-to the western horn of the entrance reef.

Naweine Point is a low rocky point covered with trees. A rock 5 feet high stands 150 yards from the point, and the fringing reef extends 500 yards from the shore. Naweine Village is situated in a bay just eastward of the point.

The coast from Naweine Point to Mumi Point takes a general. westerly direction for 7 miles. It is irregular, and fringed by coral reefs which extend 100 yards to 1 mile from the shore. This reef has four breaks in it; safe for the entrance or exit of very small coasting craft, namely, Kulundrusi, Nangingi, Werekonunu, and Ngalo Ngalo Passages.

Ndromonanuku boat passage, 1¼ miles 77° from Ngalo Ngalo Passage, is 90 yards broad, with rocks inside the mouth.

Ngalo Ngalo Passage, 2 miles westward of Nawaine Point, is the fairway for boats and canoes to the Salt Lake. It is 80 yards wide and well marked, being situated between two islets; the depth between the outer horns is 7 fathoms. Small craft anchor just inside the islets, the channel to the Salt Lake being of coral heads, and navigable only for boats.

Na Vava Plantation is situated on the west side of Ngalo Ngalo Passage, ¾ mile from the entrance; off it there is a pier and ferry.

The Salt Lake, situated 1½ miles within the entrance of Ngalo Ngalo Passage, is ¾ mile long by 670 yards broad, and 2 fathoms deep. Boats and canoes are hauled across the isthmus, at the northeastern part of the lake, where the distance from Nateva Bay is from 300 to 400 yards, and the ridge of hills only 120 feet high.

Werekenunu Passage, the next entrance to the westward, is 90 yards across at the mouth. There is a rock in the center of the passage, and one on the west horn of the entrance reef.

Shallow water extends for nearly 200 yards from the east horn. Tide ripplings are strong in the passage.

Vuriange Passage is 50 yards across, and suitable for boats only.

Nangingi Passage, 100 yards wide, is separated from Kulundrusi Passage by a conspicuous black rocky point, the distance between the two passages being 600 yards. On the east side of Nangingi Passage is a rocky islet.

Kulundrusi Passage is 140 yards broad at the mouth, but has many rocks inside which are not clearly seen on account of the muddy discharge from the stream at the head of the creek. A coral head, with 2 or 3 feet on it at low water, is situated 100 yards southward of the west horn of the entrance reef, a boat passage only.

Mumi Point is surmounted by a sharp wooded hill named Mount Murray, which has a well-defined summit 680 feet high.

Sana boat passage, 10 yards wide, named after the plantation opposite to it, is 1 mile 325° of Mumi Point. It is not safe to attempt this passage in rough weather.

Narangai Islet, 500 yards westward of Mumi Point, is a rocky islet with scrub on it, making its entire height 30 feet.

Landmark.—The most prominent landmark along this coast is Suva Suva, a cone-shaped peak, 1,110 feet high, overlooking Naindi Bay.

Naindi Bay is 240 yards wide at the entrance and ¼ mile in extent, having anchorage in from 3 to 5 fathoms, mud. It is open to the southward.

Wainimba boat passage, ½ mile east of Naindi Bay, is 40 yards wide, and has a coral head in the center, which has 3 feet on it at low water.

Naithekoro Passage, in the bay 3 miles eastward of Savu Savu Point, is 80 yards across, and has 13 fathoms between the horns of the reef; it is open to the southward.

A mushroom-shaped rock 15 feet high, with a single palm on it, marks the west side of the passage.

Savu Savu Bay has an excellent landfall, the high promontory which ends in Savu Savu Point standing out in relief and showing distinctly the entrance to the harbor.

The bay is comprised between Savu Savu Point and Kumbalau Point, and is 18 miles wide by from 3 to 8 miles in depth; the western half being protected by barrier coral reef, through which there are three passages.

The best anchorages are in the eastern corner of the bay; but there is good bottom and adequate protection in any part of it.

Point Reef extends 1½ miles southwestward of Savu Savu Point. It is clearly defined, being awash at low water, and can be passed with safety on a moonlight night, provided that there is a vigilant masthead lookout.

Via Via Island, on Point Reef, is formed of sand and coral and lies ½ mile southward of Savu Savu Point; there is a clump of cocoanut trees on it, making its entire height 60 feet.

Point Passage is the best and most frequented channel into Savu Savu Bay. Entrance and exit is easy in any wind, as the channel is 1½ miles wide between Point Reef and Sybil Rocks, and the depth is from 50 to 70 fathoms in the fairway.

Sybil Rocks, situated on the westward side of Point Passage, are a group of small coral heads with from 6 to 10 feet water, the shallowest spots of a bank, on which the normal depth is 2 fathoms. The sea does not break on them, and they do not show clearly after rain on account of the muddy discoloration of the water.

Nyavu Passage, 9 miles westward of Point Passage, is 1,200 yards wide and has depths of 45 fathoms in its center. Vessels of any size can use this passage with a fair tide. A ledge of rocks extends nearly 200 yards off the north outer horn of the reef.

Kumbalau Passage is situated 1¾ miles northeastward of Kumbalau Point. It lies northeastward and southwestward, is 1,000 yards long, and has a depth of 34 fathoms in the fairway.

Anchorages in Savu Savu Bay are numerous. Those best protected are Valanga Bay, Savareka Reka Bay, and Na Kama Creek, on the eastern side. The first two named are partially open to the westward, from which direction, however, no sea is ever experienced; but the latter is a reef-locked creek, admirably suited for docks or building yards. See plan of the creek.

Valanga Bay, the northern of the three anchorages just mentioned, is 1,200 yards broad, having depths of from 10 to 19 fathoms, stiff mud.

A coral patch barely covered at low water and steep-to around is situated nearly in the center of the bay.

Water of good quality can be obtained from a stream discharging itself in the southeast part of the bay.

It is high water, full and change, in Valanga Bay at 6h. 0m.; springs rise 4½ feet, neaps range 3¼ feet.

Savareka Reka Bay, about 1 mile south of Valanga Bay, is from 500 to 1,400 yards wide and has anchorage in from 6 to 18 fathoms, mud.

At the south part of this bay the fringing reef extends ½ mile from the shore and encircles Nawi Island, which island is the northern protection to Na Kama Creek.

Na Kama Creek is 1,300 yards long east and west, with an anchorage breadth of 150 yards and a depth of from 15 to 6 fathoms in the middle.

Nawi Island, on the north shore of the creek, is 900 yards long east and west by 450 yards north and south, and divided into two parts by a mangrove swamp. The highest point, at the west end of the island, is 130 feet above the sea.

On the south shore of the creek and 200 yards from the beach there are some boiling springs (Waikama), generally in active operation, and which form a considerable stream, flowing into the creek at Moniseva.

Between Moniseva and Ndaku, 1 mile to the westward, hot springs occur along the beach at several places.

Shoal.—A shoal of 1½ fathoms is reported to be situated in this creek at about 150 yards southwestward of the south extreme of Nawi Island.

Supplies.—Fresh meat can be obtained at Moniseva. Yams, bananas, breadfruit, and pineapples can be procured from many of the plantations around Savu Savu Bay. Water can be obtained at Ndaku.

Boat navigation between Savu Savu Bay and Somo Somo Strait to the eastward can be effected inside the reef except between Naithekoro and Wairuku; between Sava and Nangingi; between Ngalo Ngalo and Ndromonanuku. High water is required for a coral bar westward of Ngalo Ngalo and three coral bars between Naweine Point and Levuka lai lai Passage. Three-quarters flood is required for other parts between Savu Savu Bay and Levuka lai lai. Between Levuka lai lai and Viani Bay half tide is necessary.

The coast from Kumbalau Point to Soni Soni Island takes a general direction southwest for 4 miles. Off the coast is a barrier reef which ends in a prominent horn, bearing 106°, distant 2¾ miles from the summit of Soni Soni.

Anchorage can be found inside the barrier, but the water is deep and the bottom uneven.

Soni Soni Island is of volcanic formation, covered with grass, and has a well-defined summit 460 feet high. It is separated from the main island by a very narrow channel in the mangrove. On the northeast side of Soni Soni there is a good boat harbor in which there is a small islet named Na Vatu, the site of the principal village of this part.

Soni Soni Passage, through the barrier reef, ½ mile southward of Soni Soni Island, is 1½ miles long and 320 yards wide in the narrowest part. The course through when entering is 297°.

Foul ground, the depth of which has not been ascertained, is reported to be situated in the western approach to this strait at about 1.6 miles 134° of the extremity of Vatu Vuna Point.

Barrier reef.—**Namena Reef** is a narrow coral barrier stretching off the southern coast of Vanua Levu in a southeast direction for 15 miles. In the lagoon inclosed by this reef and 3½ miles from the extreme outer horn is Namena (Direction) Island, 320 feet high, which is 1 mile long in a northeast and southwest direction by ¼ mile broad.

Namena Reef incloses a lagoon, which is 13 miles long by 2 to 3 miles broad, the general depth being from 16 to 20 fathoms. On both sides it is broken up into detached patches, between which vessels can pass.

Small sailing vessels on passage between Savu Savu Bay and Makongai cross Namena Reef by the Save-a-tack Passages, which are safe in daylight for 11 feet draft.

North Save-a-tack Passage is found by bringing the summit of Namena Island 184°.

South Save-a-tack Passages are numerous. The barrier reef is sunken for 1½ miles westward of Namena Island, and small vessels can cross it at this part, looking out for coral heads; or by one of the deep passages farther southeastward.

The southeast horn of the barrier reef is situated 13 miles 224° of Namena Barrier Reef, and 6½ miles 122° of Vatu i thake or Passage Island; the sea breaks with great violence on this portion of the barrier, and there are heavy tide rips off the extreme point, which forms the western boundary of Makongai Channel. From this southeast point the trend is northwestward and northward for 25 miles; it then curves away eastward, joining Namena Barrier Reef.

The reef throughout is broken up into patches, between some of which are ship passages; the majority, however, are suitable only for small craft; the tide sets through these passages strongly at times, and there are generally tide rips in them.

Nandi and Yuya passages are those recommended for large vessels, and are mentioned with the harbors or anchorages within them.

Vatu i thake (Passage Island), small, rocky, and 104 feet high, is connected with the inner edge of the barrier by a patch of sunken rocks.

The barrier reef now becomes broken up into innumerable small patches, between which there is in most cases deep water, and extends in a northwesterly direction for 20 miles, and there are some conspicuous bowlders on some of these patches awash at high water. The barrier form now disappears, and the reefs become scattered and disconnected, the soundings outside them gradually deepening to the 100-fathoms line, which curves away in a north and northwest direction, at a distance of 8 or 9 miles from the shore and passes 2 miles south of Yendua Island.

Caution.—The northern portion of the space inside the Vanua Levu barrier reef, as far west as the Yuya Passages, is comparatively free from dangers, the southern portion, however, is studded with reefs and sunken rocks, and although probable that the positions of the greater part of these have been determined, it is quite possible that others exist. The greatest caution therefore is required when navigating among them, and a vigilant masthead lookout necessary. The depth inside the barrier reef ranges from 25 to 35 fathoms.

VANUA LEVU—SOUTHWEST COAST.

Coast.—Wai Nunu River has a breadth of 400 yards at the entrance, which is, however, much contracted by coral and mud flats, and only adapted for boats; about ¾ mile within the entrance is a small islet, which boats should pass eastward of. Water of good quality is obtained from a small stream on the east side of the entrance.

Between Wai Nunu River and Nasawana Bay, the fringing reef, which in some places extends 1¼ miles offshore, is broken up into many creeks, which afford anchorage for small craft. The space outside the shore reef is comparatively free from dangers and the holding ground is good. Vessels anchored hereabouts, however, are likely to be subjected to a heavy sea with strong southeast winds, the barrier reef 9 miles distant being little or no protection.

Shoals.—A chain of coral patches extending in a north and south direction are reported to be situated in this bay at about 1¾ miles south-southwestward of the entrance to Wai Nunu River.

Nandi Passage and Bay.—Venara, Nandi, and Solevu Bays are close to one another, and being exposed to the south and east are open to the same objection as quoted above. Roman Catholic Mission stations are established in Nandi and Solevu Bays.

Nandi Passage, 8 miles southeastward of Nandi Bay, is 1 mile wide, with deep water between several patches of 2½ to 5 fathoms. Leading peak in line with the foot of Nandi Bluff, bearing 309°, leads to the entrance, and when inside, just northward of Nole Coral Patch, the tide rips are strong in the passage. The Leading Peak in line with the Mission House 307° leads to Nandi Bay Anchorage, in 5 to 7 fathoms.

Coast.—Vuya Point lies 2½ miles westward of Solevu Bay. Off this point a tongue of reef extends southwestward for nearly 1 mile, forming a breakwater to any sea from the eastward.

On the west side of this reef anchorage may be obtained in 8 or 9 fathoms, mud and sand.

At 2½ miles westward of Vuya Point is Coconut Point, the coast between them consisting chiefly of sandy beaches and mangrove swamp. The fringing reef extends 600 yards off it.

Vuya Passage, about 5 miles southeastward of the anchorage, has a patch of foul ground in the center, the water on either side being deep. Sesaleka Peak just open of Coconut Point leads through the southern passage. From the patch in the center these two marks are in line.

Coconut Point, with a grove of these trees on it, is low and has a village situated immediately northward of it.

There is good holding ground in from 9 to 15 fathoms, mud bottom, off the village, Coconut Point bearing 122°. When approaching this anchorage from the southward or eastward keep a good lookout for a detached coral shoal lying 500 yards off the shore reef and 246° off Coconut Point.

Water can be obtained at Coconut Point, but the stream must be ascended for about 300 yards, when the native watering place will be found. This appears to be the only watering place on this part of the coast, and boats can only get close up to the point at high water. The usual native supplies, such as yams, bananas, etc., and a few fowls can generally be obtained here.

Lamut Islet is small and bushy, about 15 feet above high water, and situated on a detached coral reef ½ mile off the coast and 1¾ miles northwest of Coconut Point. There is a boat passage between the islet and the shore reef.

The coast from Coconut Point extends 7½ miles northwestward to the mouth of a small river; the fringing reef extends 600 yards off it and follows its trend. There are several offlying coral reefs, which partly uncover at low water.

From the mouth of the small river a long low strip of mangroves extends westward, terminating in a sandy beach with coconut trees on it named Lecupi Point.

Lecupi Point appears to have been originally an island, the mangroves having gradually grown out to it.

The fringing reef surrounding it is from 400 to 1,000 yards broad, and 1,000 yards from the northwest end of the point there is a small reef, the depth between it and the shore reef being 9 fathoms.

Thakau levu.—To the westward of Lecupi Point, and separated from it by a channel 1,200 yards broad, is Thakau Levu, a large reef. On the west side of it are two rocks awash at high water, and on the southwest and southeast corners are some bowlders visible at half tide.

Mbua Bay, formerly known as Sandalwood Bay, is 4½ miles broad between Lecupi and Nai Thombo Thombo Points. The coast is densely fringed with mangroves and a river and several streams run into it.

The average depth of the bay is 8 fathoms, muddy bottom. It affords excellent anchorage in all winds and is completely protected from any sea by the large reefs in and surrounding it. The eastern part is that recommended for anchorage, the center and western portions being much contracted by some extensive reefs.

Mbua River has three entrances, situated about the center of the bay. They are all extremely difficult to make out on account of the numerous clumps of mangroves surrounding them, and as all have bars across the entrance, with only from 2 to 3 feet water on them, they are impassable except by boats. The river is about 30 yards broad at the junction of the mouth, with a depth of 10 feet, which depth is maintained for 2½ miles. For the first mile and a half the river flows through dense mangroves, after which the banks attain a height of about 15 feet, and the ground in the vicinity is well cultivated, coconuts, oranges, lemons, bananas, and yams growing in large quantities.

Supplies.—There is a station about 2 miles from the entrance of the river on the west bank and close to the principal native village; cattle and sheep can generally be procured here by giving a day's notice, and the usual native supplies can be procured at the village. Water hereabouts is not of good quality and is difficult to obtain.

Post office.—A Government post office is established at the station and there is generally weekly communication with Levuka.

Nai Thombo Thombo Point is low and rocky, and from it the coast turns abruptly northward and becomes broken up into numerous rocky points with sandy beaches between them.

Sesaleka Peak, rising over Nai Thombo Thombo Point, is 1,370 feet high and affords a conspicuous leading mark for Mbua Bay from the eastward.

Yendua Island (lat. 16° 49′ S., long. 178° 19′ E.) is situated 9 miles westward of Nai Thombo Thombo Point; it is 4 miles in length in an east and west direction and varies in width from a little over ¼ to 2 miles; its height is 641 feet and is slightly wooded with casuarina trees and screw pines.

The north side of Yendua has several deep inlets, all much contracted by the fringing reef; vessels can, however, anchor off any part of it about 600 yards from the fringing reef in from 14 to 18 fathoms, avoiding a small patch of coral lying 600 yards from it, from which the summit of the island bears 193°.

On the west side of the island there is fair anchorage in 17 fathoms, sand and coral, off the entrance to Strahan Harbor, about 400 yards from the reef, with the summit of the island bearing 100°. This anchorage, although protected from the prevailing southeast by east winds, is sometimes subjected to a heavy swell, caused by the tidal stream against the wind when blowing fresh.

Strahan Harbor has an entrance about 50 yards across. It is only available for very small vessels, the interior being much contracted by patches of coral. After passing through the entrance haul up 145°, in order to avoid a rock nearly in the center of the harbor, and anchor in 10 fathoms, sand.

Yendua Tamba, 300 feet high, ¾ mile in length, and 670 yards in breadth, is connected with the peninsula forming the south side of Strahan Harbor by a reef, across which boats can pass at half tide.

Porpoise Harbor is separatel from Strahan Harbor by a neck 100 yards across. It is open to the southeastward, and although apparently well protected by reefs, in strong southeasterly winds at high water the sea rolls in over the reefs, causing a heavy swell and rendering the anchorage insecure.

In addition to this, there are two rocks near the entrance, which renders beating out in anything but a very small craft difficult and dangerous; the entrance, which is about 500 yards across, is immediately westward of the south point of the island.

Boat harbors.—One is situated just eastward of Porpoise Harbor, the other is on the east coast; the village is situated just to the northward of the latter and a few native supplies can be obtained.

Rua Rua Islets are small and rocky and situated on the shore reef off the east side of the island. The palms on them are about 50 feet.

Tides.—It is high water, full and change at Yendua Island at 6h. 15m. Springs rise 5 feet, neaps 3½ feet. The floods set to the eastward, the ebb to the westward.

Winds.—The usual trade winds from east-southeast to southeast prevail from March to December, and the natives state that during the hurricane season the strongest squalls are from the northeastward.

Reef and sand bank.—At 3½ miles 240° from Yendua summit is the eastern end of a chain of reefs which were traced for 11 miles, extending in broken and sunken patches (over which the tidal stream runs strongly) in the direction of Alewa Kalou Island. This eastern reef has a sand bank on it which uncovers at low water springs.

Sail Rock, 60 feet high and 8½ miles 359° from Yendua summit, has much the appearance of a large vessel under sail; it has a fringing reef.

Dangers.—Between Sail Rock and Yendua Island there is a 3-fathom patch and a small reef, the latter bearing from Yendua Summit 359°, distant 4 miles. A small rock awash bears from Yendua Summit 314°, distant 6½ miles.

Between Sail Rock and Alewa Kalou there are several patches, to avoid which a good masthead lookout is necessary.

VANUA LEVU—NORTHWEST AND NORTH COASTS.

Coast.—**Mabu lai lai,** the west extreme of Vanua Levu, is a confined harbor suitable for very small craft; there is a rock at the entrance with a small staff on it as a beacon; this rock can be passed close-to; the depth inside the harbor is about 6 fathoms; good water can be procured here, and it is a suitable place for beaching a small vessel for repairs.

Ruke Ruke Bay affords good anchorage in from 10 to 15 fathoms, muddy bottom, and is protected by extensive reefs westward; there are several shoals in it, but all are easily seen from the masthead. On the south side there is a long inlet named Kora na solo, with a depth of 5 fathoms; there is a village of the same name situated at its head. There appear to be but few inhabitants on this part of the coast, consequently supplies are scarce. The shores of the bay are principally mangrove swamp, and mud and coral flats extend off them.

Rock.—A rock of 3 feet, marked by a beacon, is situated 1¼ miles southwestward of Palm Point.

This rock is close westward of the track recommended.

Palm Point, north side of the bay, is low and rocky, with some palm trees eastward of it; a small reef lies 1,200 yards westward of this point.

Inner route—Directions.—After rounding Nai Thombo Thombo Point follow the track shown on the chart.

Sleepy Point, the northwest extreme of Vanua Levu, is sandy and has a grove of coconut trees on it; there is a large village here named Savu sau; a few pigs and fowls can be procured; water of good quality can be obtained from a stream about ¼ mile southeastward of Sleepy Point, and the anchorage off it in 12 fathoms, muddy bottom, is good.

Na Vaka and Fin Peaks, on the range of hills within Sleepy Point, are 1,658 and 1,540 feet high, respectively; they are rocky and partly wooded, and the sides are covered with grass.

The Na Vaka Coast consists of mangroves and sandy beaches; the fringing reef off it extends in some places 1,000 yards offshore; it has several stones on it nearly awash at high water, and is, therefore, dangerous even for boats.

Monkey-face Pass, taking its name from the appearance of one of the rocky peaks of the Na Vaka Range; it leads in from seaward westward of Vatu Dawani Reef, and thence northeastward between that reef and the coast reef; it is 1,000 yards broad, but a small rock lies 400 yards off the shore reef, from which Na Vaka Peak bears 131°.

The space between the Na Vaka Coast and Yanganga Island has three large reefs, which are all steep-to; the track is southward of them.

Yanganga Island, north side of the track, is rocky and barren, the summit consisting of several sharp peaks; its greatest height is 887 feet. The villages are situated on the north side of the island.

There are several streams of good water on the south side, easy of access on account of the narrowness of the shore reef. Navigation on the south side of the island is comparatively easy, but the space to the northward of it is thickly strewn with coral patches and sunken rock, and vessels should on no account attempt to pass to seaward of Yanganga.

Wailea Bay, separated from Ruke Ruke Bay by a neck of land about 1 mile across, affords good anchorage in 4 fathoms, mud; the village of the principal chief of the district is situated at its head. Wailea Rock is a conspicuous rocky hummock about 700 feet high, southward of the bay.

Tamborua and Goat Islets, 99 and 90 feet high, respectively, are small and covered with grass and screw pines; they are situated on the shore reef on each side of the entrance to Wailea Bay. A sand spit extends off the south side of Goat Islet. Dillon Rock is a remarkable black pillar about 30 feet high, situated southwestward of Tamborua Islet.

Several islets and sunken patches are charted between Wailea Bay and Ngaloa Island.

Ngaloa Bay.—Eastward of Wailea Bay the coast forms a deep bight named Ngaloa Bay; a village named No Kinasi is situated on a white sandy beach in the southeast corner. At the northeast end of the bay is the mouth of Lekutu River. Shallow water extends for nearly 1 mile off this portion of the coast, and there are several sunken patches outlying it.

Lekutu River has extensive mud flats off the entrance, the channel into it being 3 feet deep at low water. The river was traced for 2 miles. A large village is situated on the eastern bank.

Delanasau Station is on this river, about 10 miles from the entrance. trance.

Ngaloa, Anatunga, Vandrala, and Tavea Islands are situated northward of the entrance of Lekutu River. Ngaloa is well cultivated and thickly populated; the principal village is on the southwest end of the island, on a white sandy beach, off which there is good anchorage, and there being no reef off the end of the sand, it would be a convenient place for beaching a small vessel.

The usual native supplies in small quantities can be obtained. Water is scarce and of inferior quality. To the westward of Ngaloa is situated the small island Anatunga, which is uninhabited.

Vandrala, to the eastward, is 98 feet high and cultivated, the plantations belonging to Ngaloa natives; there is no water on it.

Tavea, inshore, is inhabited, but no water can be obtained there.

Dangers.—Between Tavea, Ngaloa, and Vandrala Islands there are two dangerous small reefs; at high water they are particularly difficult to see should the water be muddy, as is generally the case, and the sun low. There is no passage between Tavea Island and the mainland, the coast of which from the mouth of Lekutu River is fringed with mangroves and fronted with mud flats.

Watering place.—At 1½ miles 77° from Tavea Island is situated the mouth of a stream running over a rocky ledge, forming a small cascade, which affords excellent water. Small vessels can anchor off here in 2 fathoms, mud, and boats can approach the stream at any time of tide.

From the watering place to Nuku Dum village mud flats extend off the coast for considerable distances, especially off the entrance to Ndreketi River.

Ndreketi River.—The entrance to this river, through the extensive mud flats off its mouth, is continually changing and requires marking before attempting to take a small vessel up. Small craft of 20 to 30 tons have entered the river, which is 300 yards wide with a depth of from 2 to 3 fathoms in the deepest part, and is considerably narrowed by mud banks. Soundings of 4½ fathoms were obtained on ascending the river at the distance of 4½ miles from its mouth.

The general trend of the river is a southeast direction.

The water is frequently discolored off the entrance as far out as the 10-fathoms line.

Oandrau and Nukutu Islets, on the north side of the fairway, are small and sandy, with coconut trees on them; a coral spit extends to the eastward off Nukutu Islet for a distance of 800 yards.

Nuku ira, Na Ndongu, and Vatuka Islands are situated on the offlying coral reefs; there is anchorage almost anywhere near them in the fairway, the bottom being mud and the holding ground good.

Situated 1¾ miles westward of Nuku ira Island is a small islet with a conspicuous single palm on it.

Ravi Ravi Point is backed by numerous hills from 700 to 900 feet high, topped with rugged black stones; 1½ miles southwest of it is Vana Point, having a detached reef lying 400 yards off it.

Tuna Islet, 100 feet high, is situated on the shore reef north of Ravi Ravi Point.

From Ravi Ravi Point the coast to the eastward is backed by ranges from 1,000 to 2,000 feet in height, sparsely wooded, and the summits in some cases being rocky.

Rock.—A rock of about 2 fathoms, marked by a buoy, is reportel to be situated on the north side of the channel at 1½ miles westward of Tuna Islet.

Nukumba Island is 80 feet high, with a sandy beach on the southwest side and a sandbank off the southeast end.

Mathuata Island is 1½ miles long, somewhat saddle shaped, the hills being about 500 and 300 feet high; the northeast hill is wooded.

On the northeast side and connected with Mathuata by a sandspit, is Mavuva Islet.

Shoals.—A chain of three shoals, lying parallel with the shore reef, are reported to be situated in the channel southward of this island.

Kia Island, 12 miles northward of Mathuata, is 780 feet high and situated just inside the north point of the barrier reef; it forms a most conspicuous landmark for making the coast. To the eastward of it are three small islets named Moka, Kora, and Solia. There is little water on Kia Island, but the usual native supplies are obtainable.

Great Sea Reef.—**The barrier reefs,** with numerous openings, extend from about 8 miles northwestward of Alewa Kalou (Round Island) in a 77° direction, broken more or less, for about 90 miles, toward the central part of the north coast of Vanua Levu, around which they continue but closer to the shore. These barrier reefs form a natural breakwater against the sea raised by northerly winds to the waterway between Viti Levu and Vanua Levu, as also, in some measure, to the north coasts of those islands, from which, however, they are distant from 20 to 45 miles.

Passage—Direction.—There is a good passage on the western side of the barrier reef with Kia Island summit bearing 52°; thence follow the track on the chart; there is another entrance, Mali Pass, farther eastward.

Coast.—**Low Point** is a low mangrove point 2½ miles eastward of Mathuata Island, a reef of coral extends 500 yards 347° from it, and northward of it are two small detached reefs, awash at low water.

Nanduri is a native town on the coast 4½ miles eastward of Mathuata; there is good anchorage at 800 yards north from the beach in 5 fathoms, mud, and good landing at the town pier. Supplies of fowls, fruits, and vegetables in small quantities can be obtained.

Na Kandranui Island, 2½ miles northwestward of Nanduri, is a small mangrove island with a group of coconuts, 45 feet high. Nasuviyanga is a similar island lying 1 mile 145° of it. Motua Island, of the same character lies, 1¼ miles 359° of Nanduri.

Thakavi Island, eastward of Kandranui, is 1,800 yards long and 500 yards broad, with a clump of coconuts at the southwest extreme, 63 feet high.

Nangano Island, 68 feet high, lies northward of Thakavi, the fairway between them is ½ mile wide. Ta Lai Lau Islands are low mangroves situated westward of Nangano. The islands in this locality are known as the Tiri Islands.

Thukini Island is 1½ miles long east and west anl ½ mile wide. It consists of mangoves on a coral reef. Nuku Nuku Island, 30 feet high, lies ½ mile northward of it.

Ulusori Peak is a conspicuous rocky hill, 1,141 feet in height, over Middle Point; at 1½ miles southwestward from it is another conspicuous peak, 1,392 feet high. Wai Levu is a river 6½ miles eastward of Middle Point, it is navigable by small boats for 3½ miles. The Lambasa sugar estates are situated on the east bank of this river.

Radio.—A radio station, open to the general public, is established at Lambasa sugar estate; the call letters are V. P. E.

Lambasa and Ngawa Rivers are entered through channels in the mud flats extending off the coast, and staked; there is 3 feet water on the bars. The two streams join 2½ miles up, by deep, narrow, winding creeks, just above which are the sugar estates. The Ngawa is navigable for boats 3 miles above the junction. The Lambasa trends a considerable distance and is navigable 10 miles by boats.

There is frequent communication with Suva and Levuka, and steam vessels of 2,000 to 4,000 tons periodically bring coal and load sugar. No supplies can be obtained.

Mali Island (lat. 16° 18′ S., long. 179° 18′ E.) is 3 miles long by ¾ mile wide and 562 feet high; it is covered with casuarina trees and has several villages on the north coast. Voro Voro Island is 292 feet high and very rocky, joined to Mali Island by a coral reef awash at low water.

The anchorage is between Mali Island and the mud flats extending off the mouths of Lambasa and Ngawa Rivers, in 6 fathoms, at 1,200 yards offshore abreast Ngawa River, soft-mud bottom.

Tide.—It is high water, full and change, at Mali Anchorage, at 5h. 52m.; springs rise 5½ feet, neaps 3½ feet.

Mali Passage is a wide and steep passage through the reefs northwest of Mali Island, 3 miles in length north by west and opposite; during springs the tidal stream runs with much force.

Leading mark.—A rounded grassy hill at the back of Lambasa, marked 964 feet on the chart, in line with the westernmost hill on Voro Voro bearing 143°, leads through Mali Passage.

Shoals.—Waterwitch Rock is situated within the passage, 1,800 yards 257° of Voro Voro Island; there is a depth of 5 feet over it, surrounded by a 3-fathom bank which is difficult to see.

Maorie Shoal, at 1 mile southwestward of Mali Island, is small in extent and comprised of several coral heads, with a depth of 2 fathoms over them. It is marked by a white buoy.

Wilson Shoals are a group of coral heads situated 2 miles southwestward of Mali Island, with depths over them of 5 feet to 3 fathoms; they can not be seen even on the finest day until within 50 yards of them. A white buoy marks the shoalest spot.

Jubilee Reef lies 1 mile westward of Wilson Shoals, south side of the fairway, with a depth of 3 feet; a white buoy marks the southwest end.

Corbett Rock is situated about midway between the barrier reef and the northeast end of Mali Island; it is small and has a depth of 5 feet over it; the channel is northward of it.

Marama Reefs are between the east end of Mali Island and the coast; they dry at low water and are not difficult to see; this channel is not recommended.

Capps and Hastings Reefs lie in a line about midway between Sau Sau Islet and Mali Island and 359° of Roberts Point, each reef has a sand cay visible at all times. Pearl Rocks lie 1½ miles 212° from Sau Sau Islet; they are a group of coral heads, with from 1 to 3 fathoms over them. These are all southward of the recommended track.

Mbuthai Sau River extends upward of 8 miles inland in a 167° direction, navigable for small vessels of less than 6 feet draft. There is a depth of 2 feet on the bar; when inside, a depth of 6 to 8 feet can be carried 6 miles up. The country around is cultivated for sugar.

Sau Sau Peak is a conspicuous grassy hill, 1,319 feet high, situated 2 miles inland. Sau Sau Islet, situated on the barrier reef about half way between Sau Sau and Mali Passages, is a small rocky mound covered with grass, sparsely wooded, and 123 feet high; reefs extend 300 yards from its southeast point.

Matiavai is an island situated 1½ miles eastward of Sau Sau Islet and close to the coast; it is very rugged and rocky, 343 feet high; Leading Point is its north extreme.

Wai No Koro River flows into Sawana Bay and extends 12 miles inland; it is navigable for boats 8½ miles, the depths varying from 3 feet to 12 feet.

Thalo Nggenggi is a conspicuous rock, 40 feet high, 500 yards northward of Nari Roso, with which it is connected by a sunken reef. Nari Roso (Graves Point) is a high, rocky, and wooded promontory facing Sau Sau Passage.

Sau Sau Passage is 2½ miles long by 1,300 yards wide at the entrance, with a depth of 36 to 46 fathoms. The passage on the west side is bordered on the two extremities by the barrier reef, and on the east side by a point of reef and by Pasco Bank. When using this passage keep in mid-channel.

Thorp Shoals comprise a number of sunken reefs with from 2 to 3 fathoms over them; they are situated between Sau Sau Passage and the land. No vessel should pass between them except with a favorable light.

Pasco Bank is on the eastern side of Sau Sau Passage, having depths of 2½ to 4 fathoms on it. Care should be observed as the tides set across the bank.

Tutu Island (Blunt Island) is joined to the mainland by a reef and situated 2½ miles 235° of Ndrua Ndrua Island; it is 634 feet high, rocky, and wooded; there is a village on both the east and west coast.

Nuku Vandra (Henderson Island) is a small sandy islet, 60 feet high, situated 1 mile northwest of Tutu Island; it is covered with trees. The coral reef extends 700 yards north of the island.

Langa Langa River, southward of Tutu Island, extends 6 miles inland, and is navigable for boats 3½ miles, with a depth of 6 to 10 feet. The depth on the bar is 2 feet at low water. Vui Malanggeo, 2 miles farther eastward, is navigable by boats about 2½ miles in depths of 6 to 9 feet, through dense mangroves. The depth on the bar is 1 foot.

Yanutha is a small island, 125 feet high, joined to the coast by the shore reef; it is a Government reserve, but uninhabited. Ngevo Island (Hanbury) is 463 feet high, very rocky, and thickly wooded. There is good landing on a sandy beach at the south extremity.

Kavewa Island is ¾ mile long, wooded, and 233 feet high. There are two villages. Vatu i Kavewa is a conspicuous rock, 60 feet high, with a single palm on its summit, situated on the inner barrier reef ½ mile northwestward of Kavewa.

Vatu i Wai (Sail Rock) lies ½ mile northwestward of Vatu i Kavewa; it is 55 feet high and conspicuous, much resembling a boat's sail from a distance. Katawangga, 40 feet high, lies 1,400 yards west of the south extreme of Kavewa.

Ndrua Ndrua Island is 1½ miles long, having a table topped summit, 438 feet high; it is rocky and wooded. Vatu Vuri (Monk's Rock) is conspicuous, 101 feet high, and situated northward of Ndrua Ndrua.

Na Savu River flows into Timbithi Harbor and is entered through a narrow channel in the mud flats; there is a depth of 2 feet on the bar. Boats can ascend the river for 7 miles, with depths of from 1 to 4 fathoms.

Na Mbukalau Island, at the head of the above harbor, is 130 feet high, wooded, and inhabited.

Tilingitha Passage is the entrance to Timbithi Harbor through the Barrier Reef; it trends north and south and is 800 yards wide, with depths of 45 to 48 fathoms in the narrowest part, and thence gradually shoals to the land. From Ndrua Ndrua Island eastward there is no inshore navigation to Timbithi Harbor except for small trading boats, and from there on to Mbekana and Cape Undu only small boats can navigate with difficulty at low water.

Timbithi Harbor.—Tilingitha Island, 85 feet high, is 1,000 yards long and 600 yards broad, wooded with coconuts and mangroves; it is inhabited. There is good anchorage in 5 fathoms, mud, with the north extreme of the island distant 1,800 yards and in line with Mount Thuku.

There are several small reefs in Timbithi Harbor, westward of the above island, difficult to see in consequence of the discolored water.

Tides.—It is high water, full and change, at Tilingitha at 5h. 50m.; springs rise 5 feet, neaps 3¼ feet.

Mbekana Harbor is 4 miles eastward of Timbithi Harbor and can be entered through a pass named Nuku Sa, 450 yards wide, and with depths of 17 to 23 fathoms.

The passages through the reefs eastward of Nunda mu Pass are only available for boats.

VANUA LEVU—EAST COAST.

Cape Undu, the northeast extreme of Vanua Levu and the northern limit of Nateva Bay, is a narrow, well-marked peninsula with many clearly defined hills, gradually diminishing in size toward the cape itself. It is fronted by a coral reef, chiefly of the fringing character, which projects beyond the cape to the northeastward for 3 miles, terminating in a sharp point named Na Potu. Inside this point of reef is a shallow lagoon.

Light.—From a white hexagonal tower on iron columns, 23 feet in height, erected on the extremity of this cape, is exhibited a fixed white light, elevated 127 feet, and visible 17 miles.

Mount Thuku, situated 8 miles 235° of Cape Undu, is a conspicuous saddle-shaped mountain 1,288 feet high. Between this mountain and Cape Undu are four conspicuous peaks.

The third from Mount Thuku, named Yasawa Hill, is 560 feet high and useful as a landmark when making Yasawa Harbor.

In the portion of Undu Peninsula, between Mount Thuku and Cape Undu, there are, on both coasts, some villages.

Yasawa Harbor is on the south side of Undu Peninsula and 5 miles eastward of Mount Thuku.

It affords good shelter and is to be found by bringing Yasawa Hill to bear 359°. The bottom is, however, very uneven, necessitating care when selecting anchorage.

A small sunken rock with 6 feet over it at low tide, and difficult to see on account of the muddy discoloration of the water, lies 150 yards southwest of the extreme end of the barrier reef which forms the south protection to the harbor. After rounding this rock, proceed up the lagoon for 1 mile, until Yasawa Hill bears 314°, when fair anchorage can be obtained about midway between the shore reef and the barrier reef, in from 12 to 15 fathoms sand, mud, and coral.

The interinsular steamer calls at Yasawa at intervals.

Nateva Bay, southwestward of Ysawa, and some 30 miles in length, has not yet been surveyed.

Somo Somo Strait separates the islands Taviuni and Vanua Levu. In the narrowest part, which is between Koro Levu and Navaukana Promonotory, the navigable portion of the channel is 1¼ miles wide and from 120 to 200 fathoms deep.

The reefs on both sides are of irregular formation and seldom break; the western limit of the narrows being formed of sunken coral banks, upon which there are strong tide rips, and which are never easy to distinguish, should be avoided, and the eastern or Koro Levu side taken, when passing through. There is no passage for vessels between Taviuni and Koro Levu.

The northern approach to the strait is named Rambi Channel, between Rambi and the Iambu Group.

The passage through Somo Somo Strait is usually tedious for sailing vessels, occupying often as much as 3 days, owing to the calms and baffling winds occasioned by the lofty island Taviuni obstructing the passage of the trade wind.

When at either end of the strait, waiting for daylight to pass the narrows, it will be found convenient to keep Koro Levu in line with the extreme of Taviuni. When in the neighborhood of Champion Rocks, if drawing 12 feet and over, take care that no part of Koro Levu is open of the extreme.

In the narrows the lead gives no warning of approach to danger.

. At night it is hazardous to pass through the narrows unless the light is sufficiently good to enable Koro Levu Islet to be distinctly seen.

Anchorage can be obtainel at Vuna Point, Wairiki, Somo Somo, Ngila, and Mate off the Taviuni Shore; and off Vanua Levu Shore, inside Viani Passage, an anchor may be dropped in case of necessity.

Tidal streams.—In the narrows the flood sets southwest by south, ebb northeast by north, the turn of the tidal stream being 2 hours after and 4 hours before high water, and the speed varying according to the wind, and the age of the moon, at from 1 to 3 knots.

Vuna Point, the western extreme of Taviuni, has an European settlement on it. There is a fair anchorage in offshore winds and fine weather. From Vuna Point northward to Wairiki the shore is steep-to, and admits of no anchorage, except at the places before mentioned.

Tide.—It is high water, full and change, at Vuno Point at 6h. 10m.; springs rise 4 feet 6 inches, neaps range 3 feet.

Wairiki is an European settlement, the most conspicuous building being a Roman Catholic church. There is also a store and a post office.

Anchorages may be had with any but strong north or west winds in from 11 to 15 fathoms, outside the line of coral heads which fringe the coast.

Somo Somo is a native town 1 mile eastward of Black Point in the strait. It is the residence of the Roko Tui of the district, a Province which comprises Taviuni and a large portion of Vanua Levu.

Anchorage in 15 fathoms, sand and mud, may be obtained with any but strong north winds, the mouth of Somo Somo River bearing 145° and Koro Levu showing inside of the south extreme of Vanua Levu, bearing 269°, taking care to avoid a shoal extending 200 yards off the south side of the river.

Fresh water of excellent quality can be obtained with facility from Somo Somo River.

Koro Levu Islet, or Boat Islet, is wooded and of a dark color. It is 320 yards long by 200 yards broad, and 150 feet high to the tree tops. Situated 1,400 yards from the eastern limit of the narrows, it is a useful landmark to those navigating the strait, and can be seen on any but dark nights. It is surrounded by coral reefs awash in places at low water.

Phillips Rock is a coral bank of small extent, situated 1,800 yards 13° from Koro Levu Islet and separated from the reef of that island by a passage 1,000 yards wide and having depths of 7 to 9 fathoms. The least water over Phillips Rock is 2½ fathoms. It never breaks and is difficult to see in cloudy weather.

Caution.—When the light is not good be careful to pass northward of Phillips Rock when making for or leaving Somo Somo.

McPherson Rock is a coral head with 3 fathoms water, situated 1¾ miles 55° from Koro Levu.

Anchorage can be obtained off Ngila in from 9 to 17 fathoms, sand and coral; also in from 6 to 17 fathoms, sand and coral, 1 mile 257° from Naiselesele Point.

Naiselesele Point is the north extreme of Taviuni. The small islets off the point are formed of volcanic matter. Boats can pass at any time of tide over the reef between the islets as far as Mbuimbani.

Small sailing vessels and steamers can obtain good shelter in either of two reef harbors situated on either side of the islets off Naiselesele Point. These harbors are separated by the coral reef which connects the islands. The eastern harbor has good anchorage in 6 fathoms, sand. The entrance is 140 yards wide and has 10 fathoms in the center. Off either horn of the entrance there is a sunken coral head.

The western harbor for small craft is found by bringing the summit of Mbuimbani in line with the south extreme of the inner islet 137°. The passage is 250 yards wide and has 6 fathoms in the center. On both sides the reef is broken up into detached coral patches awash at low water. The anchorage is in from 4 to 6 fathoms, sand and coral.

Champion Rocks are 2 coral banks 6¼ miles 38° from Koro Levu. The smaller and western of the two has 2 fathoms water, the larger 2½ fathoms.

Breaknot Rocks, with depths of 1 and 3 fathoms, lies 2½ miles 322° from Naiselesele Point.

Mate Rock, 2¾ miles 1° from Naiselesele Point, has 3 fathoms of water.

Gangway Rocks are a group in mid-channel between Taviuni and Budd Reef. Two of these are awash at low water; and attached to the most northerly of the two is a long bank lying in a north by west and opposite direction, on which there are several rocks with about 6 feet water over them. The rocks break occasionally, but never heavily.

Coast.—Overlooking Navukana Promontory is a well-defined hill of the same name (Mount Coconut), 1,070 feet high.

From Navukana promontory the coast trends northward for 17 miles to Kumbalau Point, which marks the entrance to Nateva Bay. It has one bay of considerable extent and several smaller bays, and is fronted by coral reefs and backed by densely wooded mountains, the highest of which is Mount Freeland, 2,740 feet high. Around Kumbalau Point there is a well-defined barrier reef situated from 1 to 2¾ miles from the shore and protecting a lagoon, where anchorage may be obtained.

Between Navukana Promontory and Mbutha Bay, there are two snug inlets, named Nassau Bay and Ngaingai Creek, where small craft can obtain good shelter from all quarters.

Mbutha Bay, 7 miles northwest of Navukana Promontory, is 2½ miles deep, and for the most part fringed with mangroves. Anchorage in moderate depth may be found near the shore of any part of the bay. The holding ground is good, and Mbutha Bay is well protected from the eastward by Kioa Island.

Kioa Island, separated from the south point of Mbutha Bay by a passage ½ mile across, is 5 miles long northeast and southwest, and from 200 yards to 2½ miles in breadth. It is partially wooded and 920 feet high, the highest peak being near the southwest end. There are no inhabitants.

Kioa Reefs.—At 1½ miles southeast of Kioa Island there is a line of sunken coral dangers named Kioa Reefs. A connection can be traced between these reefs and those around Navokana Promontory;

and also with Florida Reefs to the northeast. All these coral banks from one barrier. Kioa Reefs seldom break.

Rambi Channel is the name given to that between Budd Reef and Florida Reefs. It is 5½ miles wide at the narrowest part and (to the southward) joins Somo Somo Strait. Budd Reef and Florida Reefs seldom break and caution is therefore necessary on the part of those navigating Rambi Channel who are not possessed of local experience.

Rambi Island (lat. 16° 30′ S., long. 179° 58′ S.) is situated 10 miles northward of Taviuni and 4 miles east of Kumbalau Point. Copra is the chief production, but cotton, sugar, tea, cocoa, and chincona are grown in small quantities, and cattle and sheep are raised.

The island is of volcanic formation, 8¾ miles long, in a northeast and southwest direction, from Cape Texas to Cape Georgia, and 4½ miles broad in the widest part. The highest peak, Mount Alto, is 1,550 feet high. The hills are densely wooded except at the plantations on the northwest coast.

At Virginia there is a fair anchorage for two small craft in any but strong north or northwest winds. Small vessels can find shelter in Albert Cove. There are also good anchorages on the eastern side at Smale Bay, Dawson Bay, Katherine Bay, and Georgia Cove.

Texas Reef.—Coral reefs fringe the south and northwest coasts. The north and east coasts are protected by an extensive coral barrier which terminates at Texas Reef in a point 6¼ miles 32° from Cape Texas. Through this reef there are several passages; the lagoon which it protects is studded with reefs.

The north point of Texas Reef is marked by a double rock 3 feet high, which is situated 400 yards from the north extreme of the break. The west side of the reef is much broken into patches, through which there are four passages for vessels. Three miles south of the north point of Texas Reef there is a passage on the eastern side with 5 fathoms water in it. Eastward of Cape Texas a spit of reef extends from the north shore barrier, but does not meet the outer barrier. The passage between is Texas Channel, and admits of vessels proceeding from Smale Bay or Dawson Bay to Virginia Cove without going around Texas Reef, a saving of 12 miles.

Anchorages.—**Virginia Cove** is a bight in the coral fringe on the northwest coast of Rambi Island, and is 400 yards broad by 300 yards deep.

Two vessels of 300 tons could lie here at single anchor. The best anchorage is in the center of the cove, where from 14 to 16 fathoms, black sand and coral, are obtained.

If a steady southeast wind be blowing, vessels remaining only a few hours can anchor in 11 fathoms, black sand and coral, closer to the beach.

Albert Cove is a well-protected coral harbor suitable for the accommodation of two small vessels. It is situated 1¾ miles 257° from Cape Texas. The entrance, easy of approach, is 120 yards broad and has 12 fathoms in the center. The best anchorage is in from 12 to 16 fathoms, fine sand.

Smale Bay, ½ mile south of Cape Texas, has good anchorage in 13 fathoms, mud, well protected by a coral reef, awash at low water at its entrance. At the head of this bay is Texas plantation.

Dawson Bay is the deepest indentation and most secure harbor in Rambi Island. At the head of Dawson Bay, near the plantations Florida and Maryland, there is good anchorage in from 11 to 15 fathoms, mud, with Mbuimbani just open of an islet 70 feet high, 2 miles 156° of the harbor. Landing is good.

Katherine Bay, situated on the south side of Rambi Island, has good anchorage, well protected from all winds.

Directions—Florida passages.—Smale and Dawson Bays are approached from Rambi Channel, through Florida Passages, which are formed by two breaks in the Florida Reefs. From the north Florida Passage (which is separated from the south passage by a line of sunken coral patches in an east-and-west direction), which is the most convenient for vessels making for Smale Bay, Cape Texas bears 328°; from South Florida Passage, which is the easiest approach to Dawson Bay, Cape Texas bears 336°.

The navigation through the lagoon to the two bays is safe with a good light and vigilant masthead lookout. Both Florida Passages have sunken rocks ½ mile inside them, which, with ordinary precaution, are easily avoided.

Georgia Cove, at the southwest extreme of Rambi Island, is a secure harbor for two small vessels. From the sea raised by north winds the cove is protected by a coral reef dry at low-water springs. The best anchorage is in 13 fathoms, sand, 100 yards from the sandy beach on the south side of the cove.

To enter it, hug the north horn of Cape Georgia which is a well-marked rocky point with a mushroom-shaped rock, 10 feet high, standing a few feet from it.

Georgia Channel is that which separates Rambi from the shore of Vanua Levu.

Between cape Georgia and the opposite shore the distance is 3 miles,-but a large reef lying half way across, limits the width of the channel to 1¼ miles. In the center of the narrows, a coral bank is situated, the shallowest part of which has 2¼ fathoms over it at low tide, and is 1,400 yards 255° off the north point of Cape Georgia.

Directions.—Those navigating Georgia Channel are recommended to keep near the Rambi shore, which is steep-to, but care must be taken to clear the spits of coral reef which jut off from the Rambi shore north of Georgia Cove, and which do not break in ordinary weather. South of Rambi the reefs are very numerous and seldom break.

Commanders of large vessels, not acquainted with this locality, would find the navigation here hazardous, and are recommended to proceed northward and round Texas Reef in preference to passing through Kioa and Georgia Channels, if intending to visit Virginia or bound for Nateva Bay.

Ringgold Isles consist of Thombia, Yanutha, Iambu, Mungaiwa, Mbeka, Rara ni Tinka, Nukusemanu, Nuku Mbasanga, Nuku Mbalate, Ngele Levu, Tai ni Mbeka, and Taulalia. The first six of these are encircled by a barrier named Budd Reef which is 33 miles round, of a singularly irregular shape, and being much sunken, the sea breaks on it only in certain places. The lagoon is deep, the soundings ranging from 31 to 44 fathoms.

Small vessels can cross the reef in many places, but the only entrance for ships is at the south end of the lagoon. A bearing of the sharp summit of Iambu, 27°, leads through a deep-water channel. There is no anchorage in a moderate depth for any but small vessels.

The southwest extreme of Budd Reef bears 66° distant 8¼ miles from Naiselesele Point, the north Cape of Taviuni. Between, lie Gangway Rocks, making the navigation unsafe at night.

Thombia, the highest of these islands, is the crater of an inactive volcano, complete, except for a distance of 400 yards on the northeast side, where the two extremities of the land are connected by the coral fringing reef, awash at low water. In the center of the crater there is a small lake 1,000 yards in length and 24 fathoms deep, the shore of which is fringed with mangrove. The sides of the crater are very steep and densely wooded, the highest elevation being on the west side, where there is a conspicuous hill, 590 feet above the sea.

Thombia is 1¼ miles from the north extreme of Budd Reef. It is a conspicuous landmark for those navigating among the reefs to the northward and eastward.

Yanutha, situated 2 miles southwestward of Thombia, is 1 mile long in a northwest and southeast direction and ½ mile broad in the widest part. It is partially cleared. The summit, which is well defined, is 480 feet high. There is good water on the island, and a small settlement on the southeast side.

Connected with Yanutha by a coral reef, awash at low tide, is Mungaiwa Island and Mbeka Rock. In the bight formed by these three, and the reefs which connect them, there is tolerable anchorage for small vessels.

Mungaiwa lies east and west. It is 1,200 yards long, 400 yards broad, and 280 feet high. A detached rock lies off its west end.

The boat channel between this island and Yanutha is 200 yards broad.

Mbeka is a rock 110 feet high, covered with bush, and situated 800 yards southeastward of Mungaiwa.

Iambu, 800 yards westward of Yanutha, is 1,800 yards long north and south by 600 to 800 yards east and west. It is densely wooded and has a very sharp summit 370 feet high, which appears equally conspicuous from all points of view.

Rara ni Tinka, or Tavuka, is a small double islet 2¼ miles southward of Yanutha. Its south part has a well-defined summit 150 feet high.

Nukusemanu Reefs and Nanuku Reefs, which are joined by sunken banks, are separated from Budd Reef by Ringgold Channel. This fairway has two reefs in it—Pitman and Miller Reefs—which are situated on its eastern side, but is otherwise apparently clear of dangers.

The lagoon inclosed by Nukusemanu and Nanuku Reefs has several coral patches in it, on which the sea breaks heavily in strong east winds, owing to the sunken character of the outer reefs. On these sunken banks, which form the boundaries of the lagoon, there are many tide rips, and the sea breaks on them, both east and west, in places.

Nukusemanu Islet, situated on the east side of the Nukusemanu Reefs, is a sand islet about 20 feet high and covered with coconut trees, making its entire height 60 feet. Landing is difficult in strong winds. Temporary anchorage in from 14 to 17 fathoms, coral, can be obtained westward of the islet.

Immediately northwestward of the reef which fringes the islet there is a good passage into the lagoon. On the west side of the lagoon the best passages by which to enter are the Combe Passages, which are to be found by bringing Thombia Summit to bear 268°. A sunken coral reef 800 yards long and having 2 fathoms over it separates them. The southern channel is the deeper of the two.

Pitman Reef and lagoon in Ringgoll Channel is 1 mile long, 1.400 yards broad, and is awash at low tide.

Miller Reef, 10½ miles 148° of Pitman Reef, is sunken. In strong south winds it breaks heavily.

Nuku Mbasanga Reef, 8 miles 77° of Nukusemanu, incloses two islets, Nuku Mbasanga and Nuku Mbalate, which are 1 mile apart.

Nuku Mbasanga has a rocky coast and is covered with coconut and other trees, making its entire height 70 feet. It lies north and south and is 800 yards long by 400 yards broad. Nuku Mbalate is a small sand islet 400 yards in diameter and covered with coconut trees, which are 60 feet high.

Temporary anchorage, protected from southwest through south to southeast, can be obtained 1,200 yards 336° of Nuku Mbasanga, outside the sunken coral heads.

Landing is easily effected by boats picking their way between the numerous coral heads into which the reef is broken up on the northwestern side.

Adolphus Reef, between Nukusemanu and Nuku Mbasanga, is a coral reef which measures 12 miles around on its outer edge. It is from 400 yards to 1¼ miles broad and varies in depth from 1 to 4 fathoms. The lagoon which it incloses has a depth of 20 fathoms in the center and has two entrances on the southwest side available for vessels of any draft. The sea breaks heavily on the southeast part of the bank; in strong winds also on the northwest horn. Those in small vessels in this neighborhood will find it more convenient to pick up a temporary anchorage on this bank for a night than to "lie to" in the channel to the northward, where the tidal streams are sometimes strong and not always regular in direction.

Ngele Levu is a low coral island situated at the east extreme of a barrier reef which is 7 miles north of Adolphus Reef. This reef, named Ngele Levu Barrier, is 33 miles round and has three good entrances for vessels on the western side. Its lagoon is more free from inequalities in the bottom than similar lagoons in these parts usually are, and has good anchorage in all parts in depths varying from 4 to 16 fathoms, sand.

Ngele Levu is 1 mile long by 1,200 yards broad, and covered with coconut and other trees, making its entire height 90 feet. On the east side there is a very narrow fringe of coral having on its outer edge several hummocks from 3 to 8 feet above high water. The village stands near a sandy beach on the northwest side of the island.

There are three passages into Ngele Levu Lagoon suitable for all vessels: Rendell Passage, Deep Passage, and Brown Passage. Of these, the most convenient and best defined, though the narrowest, is Rendell Passage.

Tai ni Mbeka.—Northwest of Ngele Levu and separated from it by only a few yards is the small islet Tai ni Mbeka, covered with scrub, and 40 feet high; and 1,200 yards westward, also on the edge of the barrier, is the larger Islet Taulalia, which is 900 yards long and 400 yards broad; it is covered with scrub, and 30 feet high. There are several rocks in the neighborhood of Taulalia Islet.

Rendell Passage is easily found, as it is situated at the west extreme of the continuous breaking reef which forms the south side of the barrier. A sand cay awash at high water, and which is clearly seen in bright weather, lies ½ mile east of the passage, on the barrier reef. From the passage the southeast extreme of Ngele Levu bears 80°. The channel is 400 yards broad and has 14 fathoms, sand and coral, in the center. The reef forming the north side of the passage seldom breaks.

The flood tide sets out of the passage to the southwest at a speed estimated at from a quarter to three-quarters of a knot; the ebb sets to the northeastward, but not so strong.

Deep Passage is 1,400 yards broad, but not well defined, as the reefs on either side seldom break. From the center of the channel the south extreme of Ngele Levu bears 88°.

Brown Passage is well marked, being at the southwest extreme of the continuous reef which forms the northwest side of the barrier awash at low water. This channel is 700 yards broad and has a depth of 10 fathoms in the center. From it the south extreme of Ngele Levu bears 94°. The reef on the south side of the passage seldom breaks.

Thakau Vutho Vutho is separated from Ngele Levu Reef by Vatauua Channel, 8 miles wide; it is about 14 miles round, and incloses a lagoon, in which there is good anchorage in 15 fathoms, sand.

On the west side of the lagoon there is an entrance 400 yards broad, which can in a good light, and with a masthead lookout, be safely navigated by vessels. The south side of the entrance is marked by a rock, awash at low water, which is usually breaking. Northwest of this rock, and 200 yards from the edge of the reef, there is a sunken coral head, which must be avoided when searching for the passage.

Thakau Mata Thuthu is 3 miles southwestward of Thakau Vutho Vutho, from which it is separated by Scatterbreak Channel.

Mata Thuthu is 13½ miles round, and has depths of from 15 to 18 fathoms, sand, in the lagoon. The entrance is on the west side and is 800 yards broad; it is well marked by having a rock awash at low water 700 yards from its southern side, which is generally breaking. The shallowest water found in the lagoon was 15 fathoms.

Both Thakau Mata Thuthu and Thakau Vutho Vutho are dangerous, because the sea breaks on them lightly.

Cocks Bank, 1 mile 212° of the entrance into Thakau Mata Thuthu, is a coral bank, 1½ miles in length, upon which the least water obtained was 14 feet. The sea seldom breaks on it, but the bank is usually marked by a strong tide rip.

Tidal streams.—The distance from Cocks Bank to Na Potu is 11 miles. Tide rips are numerous in this locality, and probably a further examination would show an uneven bottom, but no dangers were observed. The flood runs southeast and the ebb northwest, but the latter is hardly perceptible.

Among the Ringgold Isles the tidal streams are irregular in direction and force; but it may be taken, as a general rule, that the flood stream has "southing" in its direction, and the ebb "northing"; that the flood is far stronger than the ebb, but seldom exceeds 1 knot, and that vessels beating to the southeastward will generally find themselves to windward of their reckoning.

Vatauua Island (lat. 15° 57′ S., long. 179° 24′ W.), an uninhabited sand island, 16 miles 300° from Ngele Levu, is 1,700 yards long, and from 200 to 600 yards broad. It is about 10 feet above the sea, and is covered with coconut trees and bushes, making its entire height 90 feet. A coral reef fringes it, extending from 200 to 600 yards from the shore.

Temporary anchorage can be obtained on the northwest side of Vatauua Island in 15 fathoms, sand and coral, 400 yards from the reef, and sheltered from southeast winds.

Landing is easily effected during southeast winds on the northwest side, where the reef is broken up into detached coral heads.

Thikombia Island, the northernmost of the Fiji Group, is situated 22 miles northward of Cape Undu. It is a narrow, wooded island, with three conspicuous peaks, the highest of which is Thaukathi Hill, toward the west cape, and is 630 feet above the sea. The island is 6¼ miles long, in an east and west direction, and from ¼ mile to 1 mile broad. The northwest coast is bold, rocky, and picturesque; the east point low and sandy.

The southeastern portion of the island is cultivated; the western half is composed of dead coral and is wooded, but the soil is not fit for agricultural purposes. There is a village at the east extreme of the island, and two smaller villages on the west coast. Supplies of vegetables can be obtained in small quantities.

Thikombia is remarkable for the excellence of the mats which are made in the island and exported to other parts of the group. Tappa (a cloth made from the bark of the mulberry tree) is also manufactured in large quantities.

Littlebreak Spit is a ledge of sunken coral reefs and detached patches, extending from the east point of the island for 2½ miles in a southeast direction; there is seldom any break on this reef.

Anchorage.—There is anchorage for small vessels on the northwest part of Littlebreak Spit, 600 yards from the shore reef and 1,400 yards 176° of the sandy point which forms the southeast extreme of the island, in 11 fathoms, sand and coral. This small anchorage, in the close neighborhood of the coral heads on the spit, is protected from the swell raised during winds from southeastward, through east and north to northwestward, but is not safe in the summer season nor when strong southerly winds prevail.

Landing can be effected at the principal village at half tide by crossing the shore fringe of coral, which is dry at low water, and here projects from the island 1,400 yards eastward. This shore fringe is fronted by coral heads which break occasionally.

Winds.—The undermentioned winds were experienced in the northeast part of the Fiji Islands by the British surveying schooner *Alacrity*.

During 240 days of the trade wind or fine weather season (April to November), the wind blew for 152 days between south and east; for 35 days between east and north; and light westerly winds and calms were experienced for 53 days.

Nanuku Passage is the principal thoroughfare on the northeastern side of the Fiji Group. It is 16 miles wide in the narrowest part, and has for its limits, on the north side, the islands Taviuni, Ngamia, and Lauthala, the Motua Reefs, and Nanuku Islets and Reefs, from which latter the passage derives its name. On the south side the islands Vatu Vara, Nukutolu, Yathata, Naitamba, and Weilangilala, and Duff Reef.

Directions.—When coming from the northward it is recommended to make for Weilangilala, which is safe to approach, has a lighthouse on it, and to take departure from that island.

Taviuni Island ranks fourth in size among the islands of the Fiji Group. It lies northeast and southwest, is 23 miles long, from 5 to 8 miles broad, and rises symmetrically on both sides to a ridge, the highest point of which (Ngalau Mountain) is 4,040 feet above the sea, and is one of the loftiest elevations in Fiji.

Densely wooded and lying in the direction most favorable for attracting moisture, it is usually covered with clouds during southeast winds, and there is a heavy rainfall on the higher grounds. The island is of valcanic formation and capable of cultivation from summit to water line. Cotton, coffee, sugar, and copra are the chief products. Arrowroot and chincona are also grown. Yams are not plentiful, but taro grows in abundance on the east coast.

Communication.—There is communication with the capital and other places by a steamer. This vessel calls at Vuna Point, Wairiki, Somo Somo, and generally at Lauthala Island. Trading vessels and boats pass from Suva and Levuka to Taviuni frequently, except from December to March.

Taviuni Island—Radio.—A radio station, open to the general public from 9 a. m to 5 p. m., has been established on Black Point, on the west coast of this island; the call letters are V P F.

Anchorage can be obtained at Waimbula and other parts of Tasman Strait, also in Vure Vure Bay and off Salia Levu, in light southeast and offshore winds.

Caution.—There is no clearing port at Taviuni, and vessels arriving from abroad must first visit Suva or Levuka to obtain pratique.

The coast of Taviuni, from Vuna Point to South Cape, has a general southeast direction for 4 miles. At Vuna Point there is a barrier reef, the outer horn of which is 1½ miles from the shore. It incloses a lagoon, which is studded with coral reefs, and into which boats can enter, close to Vuna Point. The deepest water in the lagoon is 16 fathoms.

South Cape, the southwest extremity of Taviuni Island, is the termination of a spur from a conspicuous hill named Taviuana, 990 feet high.

From South Cape the coast takes a northeasterly direction for 4¼ miles to Ndaku Point, and from thence 10 miles to Laveine Point.

Salia Levu is the name of a sugar plantation immediately north of Ndaku Point. Off it there is a fringe of coral reef which has a break in it (caused by the river), giving shelter to boats.

Vessels can anchor in light southeast and offshore winds in from 10 to 15 fathoms, sand and coral, 400 to 600 yards 100° of the boat harbor.

Between Salia Levu and Numbani the coast is rock-bound and straight for 4 miles, without any reef to break the force of the sea. Waterfalls at this part are numerous.

Laveine Point is low, but conspicuous as the only important promontory on the east coast. A coral reef extends 1,000 yards east of the point.

Mbuma Rock is a 4-fathom coral bank 2¼ miles 30° of Laveine Point.

Thurston Rock is a 2-fathom coral head 1,300 yards 156° of Skethe Point, which is the south horn of the cape forming the south extremity of Vure Vure Bay. The north horn of this cape is Coubrough Point.

Vure Vure Bay is a small harbor, having accommodation for 3 or 4 vessels of 200 to 300 tons. The best anchorage is in 11 fathoms, black sand, with Coubrough Point bearing 145° distant 350 yards. From this position the north extreme of the spit of coral reef of Coubrough Point shows in line with the south extreme of Ngamia Island. The swell does not roll into Vure Vure Bay, being checked by Uto Mbutho and other sunken coral banks at the southern entrance to Tasman Strait.

A spit of coral reef, awash at low water and projecting from the shore into the middle of the bay, must be avoided when anchoring.

Water can be obtained from the head of the bay at high tide.

Thurston Point.—The north point of Vure Vure Bay, 1½ miles northeast of the anchorage, is Thurston Point. It is a low promontory of sand covered with trees. Stretching southeastward from this point is a long coral spit which narrows Tasman Strait to a width of 1,300 yards. From Thurston Point to Naiselesele Point the general direction of the coast is northwest and distance 6¾ miles. A coral reef fringes the coast, and off Naiselesele Point extends for 1.3 miles offshore, inclosing three small islets.

Mbuimbani is a conical island, 430 feet high on the fringing reef (cultivated with coconut trees), 1.7 miles 122° of Naiselesele Point, and 700 yards from the nearest shore.

Tasman Strait, separating Taviuni from Ngamia, is safe for vessels drawing less than 18 feet in bright weather and with a good masthead lookout. The Ngamia Shore should be kept aboard, as there are many detached reefs off the east coast of Taviuni. The narrowest part of the strait is 1,300 yards broad, and 36 fathoms in the center.

The Ngamia Barrier Reef is continued over to the Taviuni Shore in sunken patches. On the south side of the strait these coral banks are comparatively shallow, Uto Mbutho (or Turtles Back) having only 3 fathoms on it at low water; it breaks in strong southerly winds. Situated 1,600 yards 207° from the end of the coral spit southeast of Thurston Point, it is passed on the port hand when entering Tasman Strait for the southward.

Rocks.—The following rocks, whose depths are not stated, are reported to exist in this strait:

At 2½ miles 351° from the extremity of Thurston Point, and at 3.3 miles 350° from the extremity of the same point.

The western extreme of Mbuimbani, in line with the 950-foot summit on Rambi, bearing about 341°, is said to lead westward of these rocks.

Tidal streams.—The flood runs to the southward and the ebb to the northward at the rate of 1 to 2 knots per hour.

Caution.—Sailing vessels should not attempt to beat through Tasman Strait against the tide.

Ngamia is a densely wooded island, with many bays, lying east and west, 5¾ miles long and from 1,200 yards to 3¾ miles broad. It has several peaks of nearly the same height, the highest being about 1,000 feet.

Lauthala Island, close eastward of Ngamia, is 3.3 miles long, from 2.3 miles to 1,400 yards broad, and is densely wooded. It has several peaks of about the same altitude, the highest of which is 880 feet above the sea.

Ngamia is connected with Lauthala by a coral reef, which can be crossed by boats at any time of tide. The two islands are surrounded by a barrier, which is sufficiently far from the shore to admit of navigation for ships around the islands except off the east end of Lauthala, where there is passage for boats only.

The settlement on the north side of Lauthala can be reached by three passages through the reefs, either of which is available in bright weather with a good masthead lookout.

Anchorage can be obtained on the north side of the island in from 12 to 17 fathoms, coral, with the white dwelling house of the settlement in line with Palm Hill bearing 111° and distant 500 yards; also, off the spit of rocks eastward of this position in 12 fathoms, 700 yards 10° from the white house, where the bottom is cleaner but the distance from the shore greater.

Windseye Pass is 400 yards broad and is well marked, being at the end of the barrier reef 1½ miles 339° of the settlement. The barrier reef should be rounded close-to, and kept aboard until well inside the lagoon, when a course may be steered for the settlement, leaving a 2-fathom rock (which marks the end of the detached coral heads) on the starboard hand. This passage is not recommended for sailing vessels with a southeast wind.

Closeluff Pass.—From Closeluff Pass, which is 600 yards broad and has a coral patch (awash at low-water spring tides) 200 yards in diameter in the center, the east extreme of Ngamia bears 173°, the west extreme of Lauthala, in the distance just overlapping.

The soundings in mid-channel on the east side of the coral patch are 14 fathoms, on the west side 16 fathoms.

Caution.—Sailing vessels should not attempt either Closeluff or Windseye Passages against the tide unless they have a commanding fair wind.

Matangi Passage is the channel between Matangi and Ngamia and is the best for vessels bound westward from the settlement.

Care must be taken to avoid a coral head a few hundred yards westward of the anchorage, and also Macomber Rock, a coral patch awash and situated 2.3 miles 274° of the settlement.

Matangi Island is a small, densely wooded, uninhabited island in the shape of a crescent with its horns to the northward, 1 mile long and about 200 yards wide in the narrowest part. It has two hills, each 440 feet high. The bay on the north side has no protecting reef.

Motua Levu or Thane Reef, 1 mile 66° from the northeast horn of Lauthala Barrier Reef, is a coral reef of the atoll character; the lagoon has 25 fathoms in it, but no entrance for vessels. It is sufficiently sunken on the northwest side to allow boats to cross into the lagoon.

Motua lai lai is an oval-shaped reef, 1 mile in greatest diameter, 2½ miles 111° of Motua Levu. It incloses a small lagoon.

Nanuku Islets are two sand banks, covered with trees 70 feet and 40 feet high, respectively, on Nanuku Reef, and situated 1 mile and 1.7 miles from the south point of that reef, an extensive coral reef, which is steep-to on both sides, and for some distance is awash at low water. The reef forks 5 miles from its southern point. The east branch of the fork is sunken, and in light winds only breaks occasionally; the western branch curves round to the north by west, still maintaining its sunken character, and joins Nukusemanu Reef.

LAU OR EASTERN GROUP.

Wailangilala is a low island of sand and coral, covered with coconut trees and bushes, making its entire height 70 feet.

From most points of view it appears as two islets, as there is a gap in the center bare of trees. It is 1,800 yards long, 600 yards across its broadest part, and is situated at the northeast corner of a coral lagoon, 9 miles in circumference, and into which there is an entrance 240 yards wide, bearing 215° from the west extreme of the island. The beach is strewn with pumice.

Light.—Wailangilala Light is a flashing white light, elevated 95 feet above the sea, and visible 15 miles.

The lighthouse is a wooden framework structure.

(For details, see Light List.)

Duff Reef is situated 8½ miles eastward of Wailangilala. It is 6.3 miles long, 1¾ miles broad, and has a sand cay 4 feet above high water on its southern end, which is distinguishable in bright weather for many miles. There is anchorage in Duff Lagoon, and the entrance is on the southwest side.

Naitamba, 18 miles 212° from Wailangilala, is a triangular-shaped island, of volcanic and coral formation, with one conspicuous flat-topped hill, 610 feet high, overlooking the south coast, a wooded coast ridge and a depression in the center. There is a small settlement on the west side, which is easily approached by boats at any time of tide provided the wind is from an easterly quarter, and vessels drawing 5 feet may enter between the rocks at high water.

A coral barrier reef surrounds the island, which, at no place, is more than 1,200 yards from the coast.

Fresh water of good quality can be obtained at the settlement.

Yathata, formed of elevated limestone, also called Cap Island (from its resemblance to a cap when seen a long distance off), is 18 miles 224° from Naitamba, and surrounded by a coral reef of fringing character. It is 2¼ miles long and 1½ miles wide, and has a conspicuous flat-topped hill, which is densely wooded and 840 feet high.

On the north side of the reef there is a good boat passage 90 yards wide; but no anchorage, even for small vessels. Pumice was found on the weather beach.

Water is bad, and there are no supplies.

Kaimbu Island, 1,100 yards 77° from the east point of Yathata. is of elevated limestone formation, 1½ miles long, 1,000 yard broad, and 150 feet high. It is partially cultivated.

Nuku Levu Islet, between Yathata and Kaimbo, is a sand islet covered with coconut trees, making its entire height 90 feet.

Nukutolu Islets are three small islets situated 4 miles 252° from Yathata. The eastern islet consists of sand, covered with coconut trees and bushes, 100 feet high, and is surrounded by a small fringing reef, which dries at low water. Landing is dangerous.

The two western islets are connected by a coral reef. The middle islet is of sand and rock, covered with coconut trees and bushes, making its height 80 feet. Landing can be effected on the west side at high water. The west islet or rock is covered with straggling bushes and about 40 feet high.

The Nukutolu Islets are not inhabited, but are occasionally visited by the natives of Yathata for turtle and coconuts.

Vatu Vara, or Hat Island, 9 miles southward of Yathata, is a bold, picturesque, densely wooded island of limestone formation, with a flat summit, which falls in steep cliffs on all sides, and is 1,030 feet above the sea. The diameter of the island is 1¼ miles and is surrounded by a fringing reef, except at the south point, where the surf breaks unopposed against the cliffs. It is (or was) the property of an American citizen, who resides there. Landing can be effected with difficulty at high water on the north side of the island.

Malima Islets are two small uninhabited islands 25 miles northeast of Vatu Vara and 8½ miles eastward of Ngillahgillah Passage. They are situated in the center of a lagoon, which is from 1½ to 2 miles in diameter and protected by a barrier reef awash at low water. except at certain places on the north side, where boats can cross at any time of tide. The larger and southern of the islets has a conspicuous lump on its southwest extremity which is 130 feet high Pumice stone was found on the southeast beach of this islet.

Kimbombo Islets (lat. 17° 03′ S., long. 179° 02′ W.) are a group of three small islands, 6 miles northward of Ngillahgillah Island. and 13 miles eastward of Naitamba. They are surrounded by a barrier reef 12 miles in circumference which has an entrance on the northwest side. The deepest water in the lagoon is 13 fathoms.

The south and largest islet is of volcanic rock, densely wooded, and 190 feet high. There is no landing.

The middle islet is limestone, covered with coconut trees and bushes, making its height 120 feet. The north and smallest islet is of limestone 100 feet high. It has palm trees on the south end.

Trigger Rock, with 4 fathoms water, is situated 2¾ miles 197° from the south and largest Kimbombo Islet.

Bell Reef is separated from Kimbombo Reef by a channel 1,600 yards wide. It is triangular in shape, broken on the northwest side, having a lagoon in which the deepest water is 15 fathoms.

Dibbles Reef, 5 miles 32° from Kimbombo Islets, is 2¼ miles long and 1¼ miles broad. It has no entrance for vessels, but there is a lagoon inside in which the deepest water is 16 fathoms.

Williamson Reef is 1¼ miles long and 1,600 yards broad and situated 3¾ miles 325° from Kimbombo Islets. It has no opening, but there is a lagoon in which the deepest water is 14 fathoms.

Lookout Reef, eastward of Dibbles Reef, is a round coral reef, awash at low water, and 500 yards in diameter. Shallow water surrounds it for a distance of from 400 to 800 yards, breaking heavily even in light winds.

Lewis Bank, 1½ miles 319° from Lookout Reef, has a depth of 8 fathoms, sand and coral.

Jeffreys Bank lies 6¼ miles 15° from Lookout Reef. It is formed of coral and sand, and the least water obtained upon it was 9 fathoms.

Alacrity Bank lies 9 miles 66° from Lookout Reef. The least depth found upon it is 12 fathoms, sand and coral.

Directions—Suva to Lomaloma.—Sailing vessels bound from Suva to Lomaloma should endeavor to weather Ngau Island by daylight and then steer to pass to leeward of Thithia.

When approaching Tongan Passage, which leads into Vanua Mbalavu Lagoon, it is better to keep well toward Vekai, as a westerly current is often experienced off the horn of the barrier reef, south of Munia.

Levuka to Lomaloma.—When sailing from Levuka to Lomaloma it is customary to pass half-way between Thakau Momo (Horseshoe Reef) and the north point of Nairai Barrier, using a bearing of Mbatiki to clear the latter.

Exploring Isles are a group of islands inclosed within a barrier reef 77 miles in circuit, with many passages leading into it. This group is the most important in Lau.

It is one of the few barrier reefs in Fiji which have a sloping outer edge to windward, with a bank of soundings on which, in case of necessity, a vessel might anchor.

Vanua Mbalavu, the largest island, is 14 miles long and from ½ to 2½ miles broad, with several peaks on its backbone ridge, the highest of which, Koro Mbasanga, in the center of the island, is 930 feet high. The direction of the island is north-northeast and northwest, a sharp bend occurring in the center and broadest part under Koro Mbasanga. The southern half of Vanua Mbalavu is chiefly volcanic and the soil very fertile, but the northwestern part is formed of coral upheavals covered with impenetrable bush.

Lomaloma is the chief town of Vanua Mbalavu and the principal depot for produce in Lau. It is situated near the south end of the island, on the eastern coast, and behind the small island Yanu yanu, which is wooded and 260 feet high. Lomaloma is chiefly composed of native houses, but there are a few European stores and residences, a courthouse, and a spacious native church.

Lomaloma Harbor.—Between Yanu yanu and the town Lomaloma there is a small well-protected harbor, where good anchorage can be obtained for a vessel of large size in 7 fathoms, sand and mud. Sailing vessels of over 200 tons have to warp out, as there is a long spit of coral grit extending west of Yanu yanu, which narrows the space for tacking. The beach is well adapted for hauling up craft of 6 feet draft and under.

Supplies of yams, eggs, turkeys, fowls, milk, and bread can occasionally be obtained from the European residents.

Water can be obtained from a stream 1 mile north of the anchorage, but as it runs through taro beds it is not recommended for drinking purposes.

Malatta is a wooded island 420 feet high and joined to Vanua Mbalavu by the coral reef which dries at three-quarters ebb. It is separated at its southeast point from Susui by a narrow passage, dry at half tide.

Boats can pass between Vanua Mbalavu and Malatta at half tide.

Susui, eastward of Malatta, is a wooded island, lying east and west, 2.3 miles long and 1,350 yards broad. It is 430 feet high, and the coral fringe which surrounds the shore joins the barrier reef. This island is used as a grazing ground for cattle.

Munia, eastward of Susui, is a volcanic island, 2¼ miles long in a north and south direction by ¾ mile broad. One ridge traverses the center of the island, the highest point of which is 950 feet high. Vegetables and water in small quantities can be obtained.

Landing is not easy on account of the shore fringe of coral, which dries at half tide and connects the south shore of the island with the barrier reef.

Thikombia i lau, northeast of Munia, is a densely wooded island of coral formation, with several small peaks of about the same height, which make the island appear from seaward as if it had a flat summit with several notches. It is 550 feet high, and has a village named Nukulau on the south side.

A small supply of vegetables and water can be obtained. Landing is good at the village.

Sovu Islets are three uninhabited wooded rocks lying about east and west of one another and 7 miles northward of Thikombia. The highest and most westerly has a well-defined peak, which is 230 feet high. The smallest has a grove of fan palms.

Avea, westward of Sovu and off the northeast coast of Vanua Mbalavu, is a dark, wooded, coral island 1½ miles long, ¾ mile broad in the center, and 600 feet high. It has a village on the southwest point of the island. The coral fringe which surrounds the island joins the barrier reef, but boats can pass the north cape at any time of tide.

Ngillangillah is a precipitous elevated limestone island close off the northwest extreme of Vanua Mbalavu, 510 feet high, and densely wooded. It has a large cavern in it. There are no inhabitants.

Andiwathe and Yanuthaloa are small islands off the west coast of Vanua Mbalavu 250 feet and 160 feet high, respectively. In addition to those islands already mentioned, there are several smaller islets and rocks around and near the coast of Vanua Mbalavu, for the position of which the navigator is referred to the chart.

Vanua Mbalavu Lagoon—Directions.—The passages into Vanua Mbalavu Lagoon most frdequently used are Tongan Passage, on the southeast side of the barrier reef; American Passage, on the eastern side, and Ngillahgillah Passage, at the northwest corner of the lagoon and close to the island of the same name.

Tongan Passage is that most frequently used for entering. It is situated about midway between the islands Thikombia and Munia, is ¾ mile broad, and has a coral patch 250 yards in diameter and awash at low water in the center. Running into the lagoon with the prevailing wind this channel is easily navigated, provided the light is favorable. The tides are irregular. The "flood" was observed from the British surveying schooner *Alacrity* more than once to be setting out of the lagoon.

A bearing of the summit of Avea 331° will lead to Tongan Pass. Continue this course for 1¾ miles inside the lagoon until Yanu Yanu (which appears as a point of the main island standing out in relief) bears 274°, when steer for Lomaloma and enter the harbor to the north of Yanu Yanu.

These directions are intended as a guide for steering on a track the least strewn with reefs, but, from the nature of the ground, this can not be exactly followed, and the course of the vessel must be occasionally altered to avoid coral heads.

Lomaloma Harbor can be entered from either side of Yanu Yanu, but the northern is generally the most convenient.

Caution.—Unless the light is favorable and the lookout vigilant the navigation of this lagoon is hazardous. It is seldom safe to steer to the westward in it after 2 p. m.

American Passage is situated 5 miles eastward from the Sovu Islets. It is useful for vessels bound to and from Samoa and has the advantage of being easily navigated with the prevailing wind either in or out. It is ¾ mile broad, and the depth in the center is 106 fathoms. On a clear day Koro Mbasanga seen bearing 257° will lead to the passage.

Nuku Thikombia Reef, 3½ miles long, lies 4 miles southeast of American Passage, and protects it to some extent from the southeasterly swell. On its southwestern end is a sand cay 200 yards in diameter and 4 feet high, upon which there is a cairn of stone 8 feet above high water.

Ngillahgillah Passage is useful for steamers bound from Suva or Levuka to and from Lomaloma. There are many coral heads outside it, through which a course can be steered without difficulty, provided the light is favorable. The narrowest part of the passage is 300 yards wide. The tidal streams run strongly through it, but with regularity. The track to Lomaloma is around the north coast of Vanua Mbalavu, which is fronted by numerous coral heads. Off Blackswan Point the distance from the barrier reef to the shore is only 300 yards, and there is a coral patch in the center of the channel. The shore should be kept close aboard.

Sovu and Andiwathe passages.—Besides the three passages just described, there are others which are less frequented, but which are available for vessels of large size; they are the three Sovu passages, north and northwest of the Sovu Islets, and Andiwathe Passage, west of Vanua Mbalavu.

Large sailing vessels bound from Lomaloma to Suva or Levuka would find one of the Sovu passages an easier means of exit from the lagoon than beating through Tongan Pass or navigating the north side of Vanua Mbalavu with an afternoon sun.

Andiwathe Passage, from its position, is of little use to any but coasting craft.

Kanathea, westward of Vanua Mbalavu, is a round island from from 2 to 2½ miles in diameter, with some conspicuous peaks, the highest of which is 830 feet high. The island is surrounded by a reef, which on the north side extends nearly 1 mile from the shore as a fringe, and which on the east side opens out into a barrier inclosing several miles of water, into which there is no entry at low water even for boats. The northeast end of this lagoon lies 6 miles 44° from Kanathea, leaving a passage of a little over 1 mile between it and the Vanua Mbalavu barrier reef.

The sea does not break on this barrier on the northwest side, and there are very moderate rollers on the southeast side in ordinary weather. Except in strong southeast winds boats can pass over a sunken place on the southeast side of the reef at half tide by bringing a remarkable Thumb Peak to bear about 94°.

Small-craft Harbor.—On the north side of the island there is an indentation in the shore reef about 130 yards broad, in which small craft can anchor within a short distance of the beach.

Boehm Rock is a coral patch awash at low water, and about 200 yards in diameter, 1.7 miles 38° from Small-craft Harbor.

Morse Reef lies 1½ miles 145° of Kanathea, and ½ mile from the south elbow of the barrier reef. It is of small extent, with about 6 feet water, and owing to its sloping edges, breaks heavily in moderate weather. A sounding of 131 fathoms was obtained between this rock and Kanathea Barrier.

Mango Island (latitude 17° 27′ S., longitude 179° 09′ W.) is round, of volcanic origin and coral formation, 3 miles in diameter, and surrounded by a reef ½ mile broad, except at one part of the coast on the north side, where there is merely a narrow fringe, and a ledge of sand and coral, suitable for anchorage during winds from southwest through south to east.

Landing is good at the pier, except in strong northerly winds; lighters and boats drawing 4 feet can cross the reef at high water.

The highest hills in Mango overlook the southeast and west coasts, the greatest altitude being 670 feet.

Near the edge of the reef on the southwest side are three small islets, conspicuous when seen clear of the land.

The island produces sea-island cotton said to be of excellent quality. Coffee, limes, oranges, pineapples, kumalas, yams, and bread fruit are grown, and copra is exported.

Caution.—The anchorage is not safe in the summer months and sailing vessels should put to sea when the wind shifts to northeast.

Tide.—It is high water, full and change, at Mango Island Pier (north side of the island and clear from reef influences), at 6h. 10m.; springs rise 4 feet 8 inches; neaps range 3 feet.

Frost Reef, dry at low-water spring tides, lies 7½ miles 269° from Mango Island Pier. It is circular in form and nearly 1 mile in diameter. A rock 2 feet high, is situated near its northern edge.

Clearing mark.—When bound from Mango to the westward do not open the south extreme of Munia of the north extreme of Mango, until clear of Frost Reef.

Katafanga is a small island southeast of the Exploring Isles, 1,800 yards long north and south, by 600 yards broad, and surrounded by a barrier reef, which on the east side reaches 2¾ miles from the island. There are two hills, both covered with palms and of the same height, 180 feet. The formation of Katafanga is a combination of volcanic matter and coral.

On the southeast side of the island there is a small settlement.

The passage into the lagoon is on the northeast side. Several coral heads lie in it, but vessels drawing 10 feet and less can navigate it with a commanding breeze. The greatest depth in the lagoon is 13 fathoms.

Supplies.—Yams, kumalas, turkeys, fowls, eggs, and good water can be obtained.

Malevuvu Reef, 4¾ miles northward of Katafanga, lies in the track of vessels approaching from the eastward bound from Tonga to Lomaloma. It is an atoll 2¾ miles long, 1½ miles broad, and having a depth of 13 fathoms, sand and coral, in the center. Near the south end is a sand cay, awash at high water. Boats can enter on the west side at any time of tide.

Vekai is a coral rock, 30 feet high, covered with scrub, and situated on the inner edge of a circular reef 5½ miles 246° from Katafanga.

The barrier reef is 2 miles in diameter, and the lagoon has a depth of 18 fathoms in the center. Boats can enter on the northwest side of the reef at any time of tide.

Tuvutha, 5½ miles south of Vekai, is a high limestone island, densely wooded, with precipitous hills overlooking the coast, and a depression in the center in which there are four or five small lakes, one of which is reported to contain salt water.

Near the northwest extreme of the island there is a conspicuous peak, 800 feet high and 50 to 100 feet higher than the other elevations on the crater-like summit. The inhabitants live in a village named Tinoa, on the southwest coast. Food is scarce, but good water can be obtained 50 yards north of the village and also on the north coast.

A coral barrier, 400 to 600 yards in width, encircles the island. The lagoon within has a general depth of from 2 to 9 fathoms, sand and coral. A horn of the barrier, 1 mile south of the village, affords protection from the sea to small vessels in winds from southeast through east to northwest. Anchorage may be obtained in from 7 to 14 fathoms close to the reef. At 1¼ miles 325° of the village there is a boat entrance in the reef, which may be used at any time of tide.

Thakau Tambu (Gordon Reef) lies 89° distant 15.3 miles from the conspicuous hill on the northwest end of Tuvutha. It is nearly square, the length of the sides being 2¼ miles. The barrier varies in width from 200 to 1,000 yards and incloses a lagoon which has a depth of 11 fathoms in the center, and into which boats can enter from the westward at any time of tide. In southeast winds small craft can anchor outside the reef on the northwest side, with the summit of Munia just open eastward of the north hump of Katafanga—marks which can be seen in clear weather.

Tavanuku i wai (Quinin Reef) is situated 2 miles 212° of the anchorage off Tuvutha. It is circular in form, 1,400 to 1,800 in diameter, and has a shallow lagoon in the center.

Tavanuku i vanua (Smith Reef) is 3½ miles 184° from the anchorage at Tuvutha. It is from 800 to 1,000 yards in diameter, wall sided, and has a sand cay in the center which can be seen for many miles on a bright day, being 4 feet above high water. Turtle are caught here in the summer months.

Yaroua is a sand islet 500 yards long by 400 yards broad and situated 8¾ miles 306° from the southeast point of Tuvutha. It is covered with trees, making its entire height 70 feet. A reef surrounds it which extends from 100 to 600 yards from the beach. Turtle are caught here in the summer months. The landing is bad.

Those having occasion to visit Yaroua would find the anchorage at Thakau Lasemarawa useful, as there is no shallow water suitable for anchoring off the islet.

Thakau Nokeva (Freeman Reef), situated 2 miles eastward of Yaroua, is 2¼ miles long, 1¼ miles broad, and broken in two places on the northwest side. There is a small lagoon in the center, having depths from 4 to 9 fathoms. The reef dries at low water.

Thakau Lasemarawa (Hawkins Reef) lies 2¾ miles south from Yaroua. It is 1.7 miles long east and west by 1½ miles north and south, and there is a small lagoon in the center with a depth of 7 fathoms, into which there is no entry for boats. During southeast winds small craft can pick up an anchorage in 9 fathoms on the northwest side of the reef.

Thithia (lat. 17° 45′ S., long. 179° 18′ W.) is a partly volcanic and partly limestone island, nearly circular in shape. Its greatest breadth, which is from northeast to southwest, is 4 miles. The island is of a light color, the undulating country being covered with grass, widely scattered screw pines, and casuarina trees. The highest point, which is toward the northwest, is 540 feet high. There are large caverns in this island.

A fringing coral reef, from 300 to 800 yards in width, surrounds the island. It is dry at low water, but boats can pass around the island at three-quarters flood.

There are villages at various points on the coast. Landing can be effected on the northwest coast at any time. Good water is plentiful on the island.

Anchorage for small craft can be obtained during winds from south to east in a bight of the reef on the northwest side of the island, opposite Torokua village. There is also temporary anchorage to be found opposite a plantation 1 mile farther south.

Thakau Nawa (Kneass Reef) is 2¼ miles southwest of Thithia. It is oval shaped, 1 mile long, 1,400 yards broad, and steep-to around. There is a shallow lagoon in the center.

Naiau is a coral island with a similar craterlike summit to Tuvutha, situated northeast of it. The rim, which forms the summit and which is perpendicular on the sea face, is from 530 to 580 feet high, and the depression in the center is about 200 feet below it.

The island is of a dark color, being densely wooded, and appears from all points of view from seaward to be table topped. It is 3½ miles long by 2 miles broad, and is fringed, except at one place on the northwest side (where the summit rim overhangs the sea), by a coral reef which extends on the northeast side 1,200 yards from the shore.

There is no anchorage for vessels.

Boats can enter the reef opposite the village Ndevo, on the east coast, by a passage 15 yards broad, through which the stream sets out at the rate of 2 knots an hour.

Boats can pass around the island, inside the reef, at half tide, and when the passage off Ndevo is not safe landing can be effected by crossing the reef on the northwest side of the island.

Maafu Rock is a coral head with 18 feet on it at low water 7 miles 49° from the boat passage off Ndevo. The patch of discolored water, of which it is the shallowest part, is hardly 200 yards broad and has a depth on it of from 6 to 9 fathoms, coral and sand. The rock, which is about 5 yards in diameter, is on the northwest edge of the bank. It seldom breaks and is difficult to see in fine weather.

Vanua Vatu, southwestward of Naiau, is a rounded island, of coral formation, 1½ miles long northwest and southeast, surrounded by a coral barrier which joins the shore in several places and incloses a small lagoon full of rocks. The summit is crater-shaped, like Tuvutha and Naiau, densely wooded, and 310 feet above the sea at the highest point, which overlooks the southeast coast. Off the north side of the island the reef forms a horn, which strteches out more than one mile from the beach. Boats can cross the reef at half tide in the bight eastward of this horn, and there is a fair boat passage at high water on the west side of the horn opposite a sandy spit of the island. Small craft are said to anchor here close to the reef during east winds, but it is not recommended.

The inhabitants are badly off for food and water, and live on fish and coconuts.

A rock reported in latitude 18° 32′ 0″ S., longitutude 179° 25′ 10″ W., was searched for in 1879 by the British surveying schooner *Alacrity*, both in its geographical position and also in its position relatively with Vanua Vatu. In neither of these positions, however, was anything seen from the masthead, though the swell and weather were favorable for detecting banks with anything less than 2 fathoms upon them. The natives, however, persist in their assertion that a small coral head does exist between Vanua Vatu and the Na Vatu Reef, southwest of it.

Lakemba is a rounded, volcanic island, of a light color, from 4 to 5½ miles in diameter, with one projecting cape on the south side and several hills in the center about the same height and close together.

The highest point, Mount Goodenough, is a double peak 720 feet high; but Kendi Kendi (rendered conspicuous by a palm clump) is only 30 feet lower. A fringe of coral surrounds the island, which extends from 400 to 2,000 yards from the shore. Around the north coast it dries at a quarter ebb, but on the south side boats can pass at half tide. To the eastward of Lakemba there is a lagoon inclosed by a barrier reef.

There is good land around the coast, but the undulating hills in the interior are not fertile; being covered with grass, casuarina trees, and screw pines. The lower ground abounds in kumalas and yams. The latter attain great perfection in this island. Copra is exported. Turtle abound in the hot months and fish is plentiful.

Steamers can anchor in the lagoon in 13 fathoms, sand and coral, entering by Steamer Passage, which may be found by bringing the north extreme of the island to bear 296°, and conning the vessel from the masthead in a favorable light. Numerous rocks lie in the passage.

The chief village is Toumbo, off which there is a small harbor capable of accommodating two small craft. The entrance is 30 yards broad and lies northeast and southwest. The southern outer horn breaks heavily.

In winds from south-southeast, through east to north-northeast, there is anchorage at Wankatalatha in 10 fathoms, sand, where good water can be taken on board from a pool on the beach, the passage through the reef being clear for boats and the water easy of access.

Lakemba was the first island in the Fiji Group which was Christianized by British missionaries (1835).

Aiwa Islands, southward of Lakemba, are two uninhabited limestone rocky islets, 210 feet and 200 feet high, honeycombed by the sea, and only a few yards apart. They are covered with bush and connected by a reef, which is awash at low water.

The western islet is 1,800 yards, the eastern 1,600 yards long, and each are about 600 yards wide.

A barrier reef, 19 miles in length, and which has four sharp horns, surrounds these islands, and stretches several miles east and west of them. Within it is a lagoon with 20 fathoms, sand and coral, in the center. At 1¾ miles 325° of the islands there is no reef, and vessels can enter at any time, picking up anchorage where convenient.

Between the north horn of Aiwa Reef and Lakemba barrier the strait is 1¼ miles wide. On both reefs there is but a slight break.

Mbukatatanoa (Argo Reefs) lie 11 miles eastward of Lakemba and are 80 miles in circumference.

The greater portion is in the form of a barrier reef, but the center is much broken up by detached reefs and groups of sunken rocks. At 9½ miles from the north extreme of the reefs there is a narrow channel, 3½ miles long, and from 140 to 170 fathoms deep. In the lagoon the depth varies from 8 to 40 fathoms, sand and coral. On the southeast horn the sea breaks heavily.

Vanua Masi.—Inside the barrier and 3 miles south of the north extreme of Mbukatatanoa Reef lies Vanua Masi, a coral islet, 80 feet high, the resort of sea birds.

It is 800 yards long, 200 yards broad, covered with scrub, and has several rocks off its east end. Landing is easy at half tide on a sandy beach on the north side.

Bacon Island is a white rock (covered with guano), 60 feet high, 1¾ miles 75° from Vanua Masi, and 800 yards from the barrier.

Reid Reef lies 4½ miles 55° from Mbukatatanoa Reefs. It is of the barrier character, 20 miles round, and incloses a lagoon which has three islets in it, but which appeared to be tolerably clear of coral heads, and to have a depth of 20 fathoms near the center.

The lagoon is named Reid Haven; the best entrance is found by bringing Late i Viti to bear 66°, and conning from the masthead in a favorable light.

The three islets in Reid Haven are Late i Viti, Late i Tonga, and Booby Rock. The two former are 60 feet and 50 feet high, respectively, and white, being covered with guano; but Booby Rock is only 10 feet high, and of a dark color.

Malan Bank lies 1 mile 145° from the southeast horn of Reid Reef. The least water obtained was 8 fathoms, sand and coral.

There are tide rips around this bank and in the channel between Reid Reef and Mbukatatanoa Reefs; and the current on both sides of Reid Reef appears to run to the southeastward at a speed of ½ knot an hour.

Oneata (lat. 18° 26′ S., long. 178° 28′ W.), of elevated limestone, is 2½ miles long northeast and southwest, and ½ mile broad, situated within a barrier reef, 26 miles round, and which has a dangerous horn 5¼ miles 94° from Loa Islet. The highest point of the island overlooks the southeast coast, and is 160 feet above the sea.

About 1,200 yards to the northeast, and connected with Oneata by a sunken reef, is a Loa Islet (Observatory Islet), which has a sharp summit 140 feet high.

The village is in a sandy bay, on the southeast side of the island. Portions of the island are cultivated. There are few supplies, and water is difficult to obtain.

Oneata Lagoon is the expanse of smooth water which surrounds the island and which is inclosed by the barrier reef. It has four entrances, which have been named Broken Passage, Middle Passage, Schooner Passage, and Transit Passage.

Broken Passage is 1,600 yards across, with three patches in it dividing it into four channels. From the best of these channels the summit of Loa Islet bears 235°.

Middle Passage is 500 yards across and has 13 fathoms, sand and coral in the center. It is to be found by bringing the summit of Loa Islet to bear 123°. A very small coral head with 2 feet on it at low water is situated on this bearing, 400 yards inside the center of the passage. It may be passed on either hand.

Schooner Passage is not well defined and therefore not recommended for any but small vessels. From it Loa Islet bears 111°.

Transit Passage is 400 yards across and has 6 fathoms, sand and coral in the center. The south extreme of the hill on Loa in line with the north point of Oneata bearing 100°, leads to the passage, but must not be carried through, as the end of a spit of rocks connected with the northern side of the passage lies on the bearing.

When in the center of the passage, therefore, vessels should bear to the southward, steering for the south extreme of Oneata until the rocks are passed on the port hand.

Caution.—The passages into Oneata Lagoon should not be navigated by sailing vessels against the tide unless they have a commanding breeze.

When bound for an anchorage off the village, if passing around the west side of the island, keep about half-way between the reef and the shore, as there are rocks off the west point of the island.

Mothe (lat. 18° 39′ S., long. 178° 30′ W.) is a volcanic island, 2¼ miles in diameter, with one conspicuous timber-capped peak rising in the center, 590 feet high. It is surrounded by a barrier reef, which stretches for 7 miles to the southeast (inclosing also Karoni), forming a remarkable horn named Na Potu. Vessels can not enter the lagoon, but there is a boat passage on the east side in a deep bight of the reef between Mothe and Karoni, and boats can pass over the barrier on the northwest side at half tide.

There are villages, the principal of which is Nassau, on the south side. Water is plentiful on the island, but can not easily be shipped. Bread, fruit, bananas, kumalas, and yams can be had in abundance.

Anchorage can be obtained outside the reef on the northwest side of the island in 12 fathoms, sand, opposite the village Natambua, protected from the east through south to the southwest, with the summit bearing 131°.

Karoni, a small wooded limestone islet, is situated 3½ miles southeast of the summit of Mothe. It has a conspicuous peak 120 feet high. Several rocks lie off its west coast.

Mothe lagoon is comparatively shallow, the greatest depth obtained being 9 fathoms inside Na Potu. The deepest sounding north of Karoni is 7 fathoms.

There are three well-defined reefs northeastward of Mothe. Thakau Lekaleka, which is in the middle of Oneata Passage, Thakau Vau, and Thakau Motu. The two first are circular reefs of no large extent with small lagoons, but the last is an extensive danger, with the west side open, and a lagoon in which the deepest water found was 23 fathoms.

Tidal streams.—In the channel between Mothe and Komo the flood sets to the southward and the ebb to the northward. The latter appeared to have but little strength, both in this and the neighboring channels.

Komo Island (lat. 18° 41′ S., long. 178° 38′ W.), westward of Mothe, of volcanic origin, is 1½ miles long east and west and ½ mile broad. The summit is well marked by a clump of coconut trees 270 feet above the sea. The village is on the southeast side. A path leads across from the village to the north side of the island. Coconut trees are numerous on the flat land around the coast, but the hills are covered with grass, casuarinas, and screw pines.

Connected by a sunken reef with Komo is the dark rocky islet Komo Ndriki, 70 feet high and 300 yards in diameter. A coral reef surrounds the islands and joins the shore on the east side of Komo, but northward of the island forms a barrier, inclosing a harbor, having moderate depths, good anchorage ground, and a scarcity of coral heads; it may be entered and departed from easily.

Komo Harbor can be entered by vessels of moderate size, and there is good anchorage near the island in from 5 to 10 fathoms, sand and shells. There are two passages, East Passage and West Passage, either of which is available for steamers, but sailing vessels of over 200 tons should use West Passage, where there is room for working. A good light and favorable tide (or commanding wind) is necessary for either.

East Passage is 320 yards broad, but has two coral heads in it, the most southerly being nearly in mid-channel, leaving a pass of only 140 yards between it and the east inner horn of the reef. This patch is awash at low water and, though small, easily detected on a bright day. There are 9 fathoms, sand and coral, between the rock and the east reef.

East Passage is to be found by bringing the clumps of palms on the summit of Komo to bear 168°.

West Passage is 550 yards broad, and from it the coconut clump on the summit of Komo bears 134°. The rocks which form its east side are sunken, and seldom break.

Anchorage of a temporary nature can be obtained outside the barrier reef, on the north side, during southerly winds.

A boat passage, which can be made use of in almost any weather, is to be found by bringing the coconut clump on the summit to bear

246°, and the Mushroom Rock, off the northwest point, in line with the north extreme of Komo. Boats can approach the village at all times of tide.

Thakau Vuite.—Separated from Komo Barrier by a passage 1½ miles in width is Thakau Vuite (Chicks Reef), which is 2¾ miles long by 2 miles broad. There is a sand cay near its northeast end, which is 2 feet high and conspicuous in bright weather. The greatest depth inside the lagoon is 16 fathoms. Small craft can enter between the rocks on the northwest side.

Tidal streams.—Between Thakau Vuite and Olorua Reef the flood sets to the southwestward and the ebb to the northeastward.

Between Komo Barrier and Thakau Vuite the flood sets to the southward and the ebb to the northward.

Alorua (lat. 18° 37′ S., long. 178° 44′ W.) is a small but steep island, with three humps on the summit, the highest of which is 250 feet above the sea. The island is surrounded by a reef, the southern horn of which is 1¼ miles 167° of the summit, and upon which there is usualy a heavy break.

On the north side of the island there is a lagoon which has a depth of 8 fathoms in places, but which is studded with rocks. Boats can cross the reef at high water on the north side, and in southerly winds small vessels might obtain temporary anchorage close to the coral heads which front the reef here.

Tavunasithi, southwestward of Olorua, is a small, wooded coral island ½ mile in diameter and 200 feet high. It is sorrounded by a fringing coral reef, through which there is no passage, but boats can cross over the northwest side of the reef at high water.

Wangava, southeast of Tavunasithi, is a limestone island with no conspicuous feature, 3¼ miles northeast and southwest, 1 mile broad, and 350 feet high. The natives report a salt lake in the center of the island.

Surrounding the island is a coral reef, which can be entered by boats and small vessels on the northwest side at any time of tide, as, at this part, it is much broken up into coral heads, with deep water between them. There is no anchorage worthy of the name.

Tidal streams.—In the passage between Wangava and Kambara the flood runs east-southeastward and the ebb northwestward.

Kambara is a volcanic wooded island 4½ miles long north and south and 3 miles broad, the highest land overlooking the coast. There is a hill on the northwest side in the shape of a truncated cone, and having a clump of palms on its summit (470 feet high) which is conspicuous from all points of view.

The island is surrounded by a coral reef which almost disappears north of the highest hill, admitting of good anchorage in 12 fathoms.

sand and coral, protected from winds from northeastward, through east and south to south-southwestward.

The principal village is Tokalau, under the highest hill and opposite the anchorage. Canoes are built here, and kava bowls are manufactured in large numbers.

Kumalas, pumpkins, and arrowroot can be obtained, but there are no facilities for watering.

Directions.—Bring the coconut clump on the summit to bear 179° and swinging room will be found in 12 fathoms, sand and coral, 300 yards from a sandy beach, on which there is fairly good landing in boats if care is taken to avoid the half-tide coral heads which front it.

Marambo, a small wooded limestone island, 7 miles 89° from the south point of Kambara, is 1,200 yards in diameter, and has a badly defined summit 160 feet high. It is surrounded by fringing coral reefs which stretches ½ mile from the island on the southwest side. There is no anchorage. Boats can cross the reef through a gap on the north side.

Namuka i lau, northeast of Marambo, is a dark, wooded coral island, lying east and west, 4 miles long and 1 mile broad, with a badly defined summit 260 feet high, overlooking the north coast. A coral reef surrounds the island joining the shore at the west cape and on the south and east sides, but opening out on the northwest side, forming a harbor available for small vessels. The village is in a picturesque, sandy bay, on the south coast. Boats can communicate with the village by passing around the west cape at half tide or the east cape at three-quarters flood. A path leads across the island from the village to a sandy beach ½ mile east of the summit, where there are huts.

Namuka Harbor has fair anchorage in from 7 to 13 fathoms, sand and coral. The entrance is between the coral patches, which, on the northwest side of the island (as is frequently the case), take the place of continuous barrier reef.

If drawing over 14 feet, do not enter, as there are sunken coral heads between the patches.

By bringing the highest hill (rendered distinct by a sharp fall immediately eastward of it) to bear 134° a channel may be chosen where the space between the coral patches (awash) is over 100 yards. A good light is necessary, and for a sailing ship a favorable tide or commanding breeze.

Wilkes Reef lies 3½ miles 61° of the entrance to Namuka Harbor. It is 1,400 yards long by 600 yards broad and dries at low water. About 400 yards southward of the reef is a 2-fathom shoal.

Yangasa Cluster, southeastward of Namuka, consists of four limestone islands in one lagoon, which is protected by a barrier reef 22 miles round and open on the northwestward side.

This cluster belongs to the people of Mothe, who visit it occasionally to gather coconuts from Navutuiloma and Navutu i ra.

On the western portion of the barrier reef there are several rocks showing above high water, which attract attention when passing.

Yangasa Levu, the largest of the cluster, is 1.7 miles long by ½ mile broad and densely wooded. It is table topped and 390 feet high. There is no landing.

Navutuiloma is densely wooded and has a badly-defined summit 210 feet high. Good landing can be found on the northwest side.

Yavutha is a small densely wooded island with one sharp peak 240 feet high, easily distinguishable from all points of view.

Navutu i ra is densely wooded and has a well-defined summit 270 feet high. Landing is good on the southeast side.

Thakau Levu is a coral reef situated off the northeast side of Yangasa Barrier and separated from it by a channel only 1,400 yards in width. It lies east and west, is open on the west side, and has a prominent horn forming its east end, upon which there is always a heavy break. On the southwestern prong is a sand cay, 2 feet above high water, and conspicuous in bright weather.

Thakau Thikondua, 2¾ miles 134° of the sand cay on Thakau Levu, is a small round, flat reef ½ mile in diameter.

Naiabo is a small coral islet, 40 feet high, covered with scrub and fringed with a high-water line of sand. It is surrounded by a barrier reef, which is 3 miles round, and incloses a shallow lagoon of impounded water.

Thakau Reivareiva and Thakau Nasokesoke are two small flat coral reefs between Naiabo and Ongea. They are steep to all round. Both reefs dry in places at low water.

Fulanga Island is of elevated limestone formation. The interior of the basin, on the south and east sides, is thickly studded with rocks varying in height from 20 to 50 feet, but the northwest part is clear and affords good anchorage to small craft.

The exterior coast of the island is surrounded by a coral reef of a fringing character, with a passage on the northeast side 1,200 yards long, 60 yards broad (in the narrowest part), and trending north and south, which admits small vessels into the crater if taken with a commanding breeze and favorable tide. When wind and tide are in contrary directions there are overfalls in this passage which are dangerous for boats. The strength of the stream was estimated at 3 knots, but it moves directly through the channel. The passage occurs in the largest gap between the detached islands, and can be found without difficulty, as it appears from seaward to be the natural entrance.

The highest point of Fulanga is 260 feet. The principal village is Monothake, on the south coast. Canoes are built here. There are indications of upheaval on the southwest side of the island.

Water can be obtained on the northwest side of Fulanga at the village of Navindom.

Ongea Islands.—Ongea Levu and Ongea Ndriki are two elevated limestone islands inclosed within a barrier reef which is 20 miles round and which is dry at low water, and through which there is a ship passage on the western side.

Ongea Levu is 4 miles long and from 1 to 2 miles broad. It is densely wooded and 270 feet high. Numerous detached rocks are situated off its south shore. The village is in an inlet and out of view from the lagoon.

Ongea Ndriki is a rocky island 1¾ miles long and 1 mile broad. The summit is ill-defined and 300 feet high. Several detached rocks fringe its north coast.

Ongea Lagoon (Port Refuge) has fair anchorage in from 4 to 11 fathoms, sand and coral.

Barracouta Passage lies nearly east and west, is 250 yards in width, and has 13 fathoms in mid-channel.

It is to be found by bringing the most northerly of the rocks lying off the north shore of Ongea Ndriki to bear 105°.

The vessel must be conned from the masthead, with favorable light. Sailing vessels can not enter against the tide unless there is a commanding breeze.

The reef dries at low water on both sides of the passage. Situated 250 yards east of the south inner horn (with which it is connected by shallow water) is a coral head with 6 feet on it at low water, which must be left on the starboard hand. On either side of Barracouta Passage there is a good boat passage.

The strength of the tidal stream through Barracouta Passage was estimated at 2 knots, the flood being rather stronger than the ebb.

Thakau Teteika is a small circular flat reef ½ mile from the northeast part of Ongea Barrier. It is ¾ mile in diameter and has a rock showing 2 feet above high water on its northwestern edge.

Nuku Songe Reef is situated 3¼ miles 111° from the southeast coast of Ongea Ndriki. Inside it there is a shallow lagoon, and near its north extreme a sand cay 2 feet high, and there is a rock 3 feet high on its southwest edge.

Winds and weather.—In the Lau or Eastern Group between May and November the wind blows strongest and with most persistence from southeast and southeast by east, occasionally rising to the force of a moderate gale in September and October. Very little rain falls during those months. Strong easterly winds are generally accompanied by haze, which, however, permits of breaking reefs being seen 3 to 4 miles off.

The barometer in the fine months seldom moves more than three-tenths of an inch, showing highest for strong east-southeast winds (though perhaps accompanied by passing showers) and lowest for winds from northwestward.

After two or three days of calms or light winds with westing in them, the southeasterly winds sometimes sets in with a smart squall, first felt from a south or south by west direction and quickly shifting.

Temperature.—From the middle of November to the middle of April the thermometer ranged from 66° to 88°, the greatest difference between the wet and dry bulbs being 10°. The temperature of the sea water ranged from 77° to 88°, with an average of 81°.

Current.—While surveying in the Lau or Eastern Group (1878) no current worthy of mention was experienced, except in the lagoon passages, where it was in nearly every instance distinctly tidal, and in the close neighborhod of reefs, where it is probably not regular nor exceeds ½ knot an hour.

Doubtless during strong winds from southeast to east, there is a slight surface drift, but it ceases when the wind moderates. Oil casks from vessels shipwrecked at Vanua Vatu in the summer months have been recovered on Mothe Reef, showing that at this time of the year there is as much probability of an easterly as of a westerly set. In the lagoon passages the tide runs as much as 2 knots an hour, and the flood apepared to be as swift as the ebb.

APPROACHES TO THE FIJI ISLANDS.

Zephyr Shoal.—From the British naval vessel *Pearl*, when passing the reported locality of this reef, on the night of June 4, 1876, soundings were struck, obtaining two casts of 5½ fathoms.

From the British naval vessels *Sapphire* and *Alacrity* (May, 1876) search made in vain for Zephyr Shoal in the position originaly assigned to it, on which it is reported (on native authority) that a rock level with the water exists.

The British surveying vessel *Penguin*, 1895; searched for Zephyr Shoal; a bank was found in aproximately, latitude 15° 53′ 00″ S., longitude 176° 46′ 30″ W.

The British naval vessel *Penguin* anchored on this bank in a depth of 21 fathoms, and obtained a least depth of 11 fathoms ½ mile eastward of the above position, the extent of the bank being ¾ mile east and west. It is possible that less water may exist on this bank. In the course of this search the Zephyr's position latitude 16° 00′ S., longitude 177° 06′ W., as adopted) was passed and sounded over without shoal water being found.

The steamer *Manapouri* in January, 1901, saw bottom and obtained soundings of 13 fathoms over a distance of about 11 miles in approximately latitude 15° 55′ S., longitude 176° 50′ W. Extensive banks undoubtedly exist in this locality and as there may be shoaler water than already found, great caution is necessary.

Balmoral Reef, 2½ miles in length in a northwest and southeast direction, and 1¾ miles in breadth, has a least depth of 4 fathoms near its eastern edge, with general depths of 5 to 7 fathoms.

Carter Reef, reported as being in latitude 15° 42′ S., longitude 176° 28′ E., and Hammond Reef, reported as being in latitude 15° 32′ S., longitude 175° 20′ E., were searched for without success.

As these dangers are believed to be identical with Balmoral Reef they have been expunged from the charts.

The British naval vessel *Penguin,* in 1896, found a bank, with 50 fathoms water, in latitude 15° 24′ S., longitude 177° 09′ E.

Rotumah Island (lat. 12° 30′ S., long. 177° 05′ E.), discovered in 1791, was annexed as a portion of the British colony of Fiji, by request of the native chiefs, at the latter end of the year 1880.

Satarua Peak, 546 feet high, in the eastern part of the island, is an inactive crater, situated about 245 miles 347° from the northwestern islands of Fiji.

Rotumah is 7¾ miles in length, east and west, by 2½ miles in breadth. Seen from a distance of about 10 miles it appears undulating, hilly, and densely wooded, the greatest elevation being toward the middle of the island, where Mount Suelhof is 840 feet high. Westward of this the land falls to a low, narrow isthmus, 2 miles from the western end of the island, on which stands Motusa (Ituteu) village. Northward of the isthmus is formed Foviung Efau, but in consequence of the broad expanse of reef that here stretches from the shore, it does not afford much shelter as an anchorage.

Westward of the isthmus the land again rises to a remarkable wooded bluff, Soloroa, 715 feet high, with a precipitous red sandstone face to the water's edge, forming the northwestern point of Foviung Efau.

Three-quarters of a mile southwestward of Saloroa Bluff is another conspicuous, conical, wooded hill, Solmea, 540 feet high. Both these hills are similar in appearance to Uea, or Emery Island. On the northern slope of Solmea there is an inactive crater over 100 feet in depth.

At half tide a boat can pass from either side of the isthmus round the eastern end of the island inside the reef, with the exception of a short distance between Malaha, the north point, and Oinafa. A road follows the coast eastward of the isthmus, affording good communication between the numerous villages.

The island produces coconuts, oranges, limes, bananas, bread fruit, yams, taro, pineapples, and pandanus. Cattle, pigs, and poultry may be obtained. Horses are also kept on the island, and there are several traders resident here.

The warm wet climate and fertile soil are advantageous for growing sugar cane, coffee, and cotton.

As Rotumah is not a port of entry, duties on imports must be paid in Fiji.

The Resident lives on the east side of Foviung Efau Bay; his house is conspicuous. In 1896 the population numbered about 2,200, two-thirds of whom are Wesleyans and the remainder Roman Catholics. The natives are stated to speak a language distinct from any other in the Pacific. The mission station is on the south coast, at Sumi.

Uea (Emery Island) is the northeasternmost of a chain of rocks and islets lying 1¾ miles northwestward of Rotumah. It is about ½ mile in extent, rising to a wooded conical summit, 860 feet high, and is inhabited. Its coast is bold and a landing is effected with difficulty.

Hofhaviyunglola is the name of two rocks close together, 2 feet above high water, and lying 1,650 yards 246° from Uea, with depths of 19 to 40 fathoms in the channel between.

Hatana is another small rocky islet of the chain, 60 feet high, with trees and bushes on it, lying nearly midway between Uea and Hofliua, with a smaller islet immediately to the north of it, with a single tree in its center. A reef encircles these two islets, and foul ground, with blind rollers on it, extends for 670 yards to the southwestward.

Hofliua (Authaluna) is a small, bare, rocky, and bold islet, 190 feet high, situated 3½ miles 235° from Uea; it is the southwesternmost of the above-mentioned chain of islets. There is a remarkable perpendicular cleft right across it, through which the sea passes. The islet is steep-to, and no dangers could be detected around it.

Whale Bank extends from 3 to 6 miles in a 246° direction from Hofliua Islet, with a breadth of about 1 mile. The least water found on this bank is 14 fathoms, over a sand and coral bottom.

Caution.—Although no dangers could be detected at the channels between the rocks and islets forming the chain, yet the ground, being rocky and uneven, with a heavy sea running over it, it is not advisable to pass between the islets of the group.

Hauatiu (Havae), on the northeast coast, is a wooded islet with some coconut trees on its summit and a steep cliff on its northern face; the tops of the trees are 215 feet above high water. It stands on the northern extremity of the reef, projecting to the northward from Oinafa village upward of ½ mile from the shore. Close southward of it there is another smaller islet, Haua mea mea, grass covered and flat topped, 75 feet in height, with some rocks off it.

Afnaha is an islet somewhat similar in size and appearance to Hauatiu, standing on the edge of the reef, 1,200 yards from the shore off the southeastern extremity of Rotumah.

It is wooded and has coconut trees, the tops of which are 205 feet above high water, near its southern end, which is bold. Some rocks, from 5 to 8 feet high, also stand on the reef to the southward of it. Two small bold islets, standing close together near the shore off Noatau, lie ½ mile 302° from Afnaha.

Solkope is a wooded island with a prominent summit, 420 feet high, off the south coast of Rotumah, from which it is separated only by a narrow boat passage, and lying 1.6 miles 269° from Afnaha. It can not be distinguished as an island from seaward.

Solnahu is a small, flat-topped, wooded island 165 feet high, also standing on the edge of the fringing reef 1.1 miles 269° from Solkope, and close to the south coast of Rotumah, only a narrow boat channel separating them.

Limarai Rock, a small coral patch with 3 fathoms water over it, is situated nearly 1 mile from the shore to the southwestward of Rotumah Island.

The southern extreme of Solnahu Island, well open to the southward of Amnoseng Point, leads southward of Limarai Rock.

Anchorages.—There are two anchorages on the north side of Rotumah—Foviung Efau, toward the west end, and Foviung Emua, toward the east end.

Strangers looking for these anchorages might possibly experience some difficulty when making the land from the westward, as Uea Island bears a striking resemblance to the high wooded bluff, Soloroa, that marks the western extreme of Foviung Efau and appears in front of the mainland; it might be mistaken for the bluff itself.

Care must also be taken, when making the land from the eastward, to distinguish Hauatiu Islet, off Foviung Emua, from the similar shaped islet Afnaha, off the southeast extreme of Rotumah.

There is also anchorage on the south side of Rotumah, 1.3 miles 246° from Afnaha, in 15 fathoms, coral, with the eastern extreme of Solkope Island bearing 311° 670 yards from the edge of the reef fronting the village Noatau, but the anchorage is indifferent.

Foviung Efau is an open bay about 1½ miles from the west end of Rotumah. This bay is well marked by the high wooded bluff, Soloroa, on its western side, already noticed.

When making Foviung Efau, avoid closing the eastern point, as a considerable reef extends from it.

The head of the bay, right up to the narrow isthmus, is entirely occupied by reef, through which there is a boat channel, which is only available at half tide, and therefore landing is very inconvenient.

No fresh water can be obtained here.

The best anchorage is in the center of the bay, with the southern extreme of Hofliua Islet just touching the western entrance point under the steep bluff, Soloroa, bearing 266°, and the summit of Kilinga promontory (seen over the isthmus at the head of the bay) bearing 193° in 11 fathoms, sand and coral, and about 600 yards from the edge of the reef.

Although the anchorage is sheltered from the southeast trade wind, yet a considerable swell sets into the bay, but perhaps rather less than at Foviung Emua. This bay, moreover, has the advantage that if the wind should be blowing from the northward or westward, a sailing vessel would more readily clear the land.

Foviung Emua, or Northeast Roadstead, is close westward of the two islets Hauatiu and Haua mea mea, which, being connected to each other and to Rotumah by a coral reef, protection is thereby given to this anchorage during the trade-wind season, but a nasty sea sets round the island, causing a ship to roll incessantly even with the wind well to the southward. At all seasons, however, when the trade wind may be depended upon, this bay is to be preferred to Foviung Efau, on account of its facilities for landing on a smooth sandy beach at any time of tide. During the rainy season vessels may water from the wells, of which there are several, but at other times the supply is too scanty.

The best anchorage is in 6½ fathoms, sand, with the south extreme of Uea Island touching the north point of Rotumah bearing 277°, and the lower part of the cliff on the northern side of Hauatiu in line with the western extreme of Haua mea mea Islet bearing 49°.

None but very small vessels can anchor closer into the bight of the reef than the above position on account of a 3½-fathom patch; 250 yards 147° from that berth, and 120 yards 111° from the patch, there is a rock with less than 6 feet water on it, with a small coral patch close to it that dries at low water. In landing after dark boats must be careful to avoid it.

Observation spot, at Oinafa, northeast extreme of the island, is considered to be in latitude 12° 29′ 18″ S., longitude 177° 07′ 34″ E.

Tides.—It is high water, full and change, at 4h. 40m.; springs rise 7 feet, neaps rise 4¾ feet.

Hurricanes occur during the months of November to April; they are very destructive, and during the storms the natives retreat to the caves.

Climate.—During the month of September, while the British naval vessel *Penguin* was in the neighborhood of Rotumah, the wind almost constantly blew from between east by north and southeast by east, moderate to fresh breezes, but during three days it attained the force of a fresh gale. The climate is very damp.

Eaglestone Reef.—About 40 miles eastward of Rotumah Island there is reported to be a dangerous shoal of unknown extent. The information respecting it was given by the master of the American ship *Salem*, the position assigned to it being latitude 12° 20′ S., longitude 177° 50′ E.

An area of 600 square miles was searched during five days by the British surveying ship *Penguin*, 1897, without finding any indication of shoal water, the depths near its supposed position being from 1,650 to 1,900 fathoms.

The evidence as to the existence of this shoal is of the vaguest possible description, but as soundings to the northeastward indicate a rise in the bottom, it is retained on the charts until further search has been made. If a shoal exists, it must be eastward of the meridian of 178° 10′ E. The position of this shoal on the charts has consequently been transferred to latitude 12° 20′ S., longitude 178° 15′ E., with P. D. placed against it.

CHAPTER IX.

UNION, PHOENIX, ELLICE, AND GILBERT ISLANDS.

UNION (TOKELAU) ISLANDS.

This is a scattered group extending 180 miles in a northwest and southeast direction. They are all low coral islands of the atoll character and surrounded by a fringing reef. The trees growing on these islands form good marks for sighting them at a distance of 8 or 10 miles. This group is included in the Gilbert and Ellice Islands protectorate.

Supplies are very scarce in the group; a few pigs and fowls of inferior quality may occasionally be obtained. No water is procurable.

Communication.—This group is visited four times a year by a steamer from Sydney and by a vessel from Samoa at irregular intervals of about two months.

Tides.—It is high water at full and change in this group about 6h., and the rise is about 3 feet.

Current.—A westerly set of nearly 1 mile an hour was experienced in the vicinity in the month of September.

Gente Hermosa Island has a brackish lagoon in the center, having in places a depth of 8 fathoms, but there is no entrance to it. It is about 7 or 8 miles in circumference, 20 feet high, and is (or was, 1899) occupied by an American family named Jennings, who migrated there in the year 1856 from Samoa. There is no anchorage at this island.

About 800 acres are planted with coconuts, and roads are made throughout the island. Copra is exported. Supplies are scarce and no water can be obtained. There is a church and native missionary teachers.

The flagstaff on the west side of the island is in latitude 11° 03′ 18″ S., longitude 171° 05′ 08″ W.

The sea breaks constantly on all sides of this island, but there is good landing on the west side by means of passages blasted through the reef.

Fakaofu, or Bowditch Atoll. The British Government declared a protectorate over these islands on June 20, 1889. There is no anchorage off these islands.

Many distinct islands were counted, situated on a coral belt from 400 to 800 yards broad inclosing a lagoon, into which there is no passage.

The whole is 7¼ miles in length from north to south and 5½ miles wide. On the south and north points the land is higher than elsewhere, and the more elevated parts are connected by an extensive coral reef, which is awash. On the east side the land is more continuous, and on three parts there are extensive groves of coconut trees, from 70 to 80 feet high, and shrubbery.

The southern island is named Fonua Loa (Fonua means a piece of land), the northeast island Fonua Muli, and the western island Fonua Fala.

Landing is dangerous, except for canoes, abreast the village. Coconuts, fowls, and pigs can be obtained, and fish is plentiful. The islands export about 150 tons of copra annually.

The population is governed by a chief. There is both a Roman Catholic and Protestant church. Fakaofu Island is the only island having fresh water.

The observation spot north of Fakaofu Islet is in latitude 9° 23′ 02″ S., longitude 171° 14′ 46″ W.

Tides.—It is high water, full and change, at 6h. 0m. (approximately, springs rise 3 feet.

Nuku Nono, or Duke of Clarence Atoll.—The British flag was hoisted and protectorate declared on June 21, 1889.

The atoll is 7 miles long north and south and 5 miles wide, and has no entrance into the inclosed lagoon.

The northwest side is a bare reef awash, on which the sea breaks heavily. There is no anchorage here, and landing is dangerous, except for canoes, abreast the village on the western island.

In 1907 the population numbered 157, governed by a chief, all Roman Catholics. The island produces coconuts, fowls, pigs, bread fruit, and bananas; fish is plentiful. About 100 tons of copra are exported annually.

The northwest island is in latitude 9° 06′ 40″ S., longitude 171° 50′ 30″ W.

Atafu, or Duke of York Atoll.—There is no passage into the lagoon, and the sea breaks with violence on the reef inclosing it, but at high water a boat may (with proper care) sometimes cross it.

Off the northwest island a reef extends about 1,000 yards to the northwestward.

The islets on this atoll are about 8 or 10 feet high, and covered with coconut and pandanus trees; a conspicuous clump of casuarina trees is situated on the southern islet.

Anchorage.—Good anchorage, with offshore winds, in a depth of 10 fathoms, can be obtained off the northwestern extreme, at 400 yards from the shore reef.

Landing can be effected at the south end of the island.

The reefs surrounding the island are mostly steep-to.

The British flag was hoisted and protectorate declared on June 22, 1889.

The pouplation, which numbered 400 in 1911, is governed by a chief; they reside on the northwest island, where there is fresh water, but it is of bad quality. The island produces coconuts, fowls, and pigs; fish is plentiful. About 50 tons of copra are exported annually.

A conspicuous clump of casuarina trees on the southernmost island was determined to be in latitude 8° 32′ 25″ S., longitude 172° 31′ 15″ W.

Phoenix Group.—This group is composed of eight scattered islands, lying about 250 miles north of the Union Group.

They are all low coral islands surrounded by fringing reefs, which in most cases are steep-to around. But litte vegetation exists on any of them, except Sydney and Hull Islands, so that at night it is dangerous navigation in the vicinity.

Supplies are not obtainable, and on most of the islands no water is procurable.

Winds and weather.—The winds are almost constantly from the eastward, but squalls accompanied by light rain occur in the neighborhood all the year round; very little rain falls on Enderbury Island. The wind is variable from January to May, during which period bad weather is most common.

Capt. Elias Hempstead states that "during his three years residence on Enderbury Island the wind blew steadily from east-northeast to east-southeast three-fourths of the time, and during the remaining quarter from northeast to southeast; and he had never experienced the wind from the westward. Very little rain falls on the island, although it rains heavily in the immediate vicinity.

Current.—The current in the vicinity of this group sets almost constantly to the westward, at the rate of from 1 to 1½ miles per hour.

Gardner Island, or Kemins Island, the southwestern island of the group, in latitude 4° 37′ 45″ S., longitude 174° 39′ 15″ W., is a low coral island with a shallow lagoon, into which there is no navigable passage. The height, including the trees, is 50 feet.

The flood tide sets strongly to the northward; the rise and fall is about 4½ feet.

British protectorate was formally proclaimed on Gardner Island on May 28, 1892, and in 1899 leased to the Pacific Islands Co. This island has been planted with coconuts.

This island is reported to be about 14 miles eastward of its charted position.

Carondelet Reef.—The master of the ship of that name reported that when about 60 miles southeastward of Gardner Island his vessel passed about 2 miles distant from a dangerous reef, upon which the sea occasionally broke heavily.

This reef sighted May 12, 1903, and position found to be in latitude 5° 33′ 15″ S., longitude 173° 49′ 45″ E.

It has been placed on the chart in this position. The reef is described as being in the shape of a horseshoe, extending about ¾ mile in a north-northeast and south-southwest direction.

Hull Island lies 142 miles east by north of Gardner Island

The British flag was hoisted and protectorate declared on July 11, 1889, and in 1899 leased to the Pacific Islands Co. There were no inhabitants at the above date.

It has a lagoon, a little fresh water, and coconut trees on it, about 50 feet high. A coral reef fringes the island and landing is difficult except by entering the lagoon by means of the boat passages on the northwest side. There is no anchorage.

Landing.—The position of the landing place and house of refuge is marked by a flagstaff and cairn.

The west point is in latitude 4° 30′ S., longitude 172° 13′ 10″ W.

Sydney Island lies 64 miles 91° of Hull Island. It consists of a coral reef surrounding a lagoon with no opening. Wild ducks are found in the lagoons. The reef is steep-to around, except on the west side, where there is anchorage.

The British flag was hoisted and protectorate declared June 26, 1889, and in 1899 the island was leased to the Pacific Islands Co. The flagstaff at the western end of this island is conspicuous.

The island is 2 miles long and 1¾ miles broad, and 20 feet high; the tops of the trees are 90 feet above the sea.

When making this island full allowance should be made for the current, which runs to the westward at a rate of 1 to 1½ knots per hour, and if sailing vessels get to the westward it is difficult to beat up again to the anchorage.

Vessels formerly moored off the west side of the island in about 9 fathoms, about 200 yards from the reef, sheltered from the prevailing winds; but from November to April northwest winds may be expected, when it would be dangerous for a sailing vessel to anchor here. There is nearly always a southerly swell at the anchorage, which causes vessels to roll heavily at times.

The guano works are closed, and the island is planted with coconuts. There were 13 inhabitants in 1907. Landing is bad. Fish are abundant, turtle occasionally obtainable, but there is no fresh water.

The west side of the island is in latitude 4° 27′ 22″ S., longitude 171° 15′ 09″ W. Spring tides rise about 4 feet.

Phoenix Island.—This, the eastern island of the group, is 1,200 yards long and ½ mile broad.

There are no trees on this island nor any distinctive elevation, and it would be almost invisible on a dark night and difficult of detection on a cloudy day.

Reefs extend from the northwest and southwest extremes for about 600 yards.

The British flag was hoisted and protectorate declared on June 29, 1889, and the island (1899) leased to the Pacific Islands Co. There is no anchorage.

The center is occupied by a shallow brackish lagoon, which probably sometimes dries. A fringing reef surrounds the island, in which, on the western side, there is a break, affording good landing.

A current of 2 knots per hour was found setting to the westward past the island.

The north point of Phoenix Island is in latitude 3° 42′ 28″ S., longitude 170° 42′ 37″ W.

Birnie Island, 50 miles westward of Phoenix Island, is merely a strip of coral and sand, about ¾ mile in length and ¼ mile wide, elevated 6 feet above the sea, and trending in a northwest and southeast direction.

The British flag was hoisted and protectorate declared on July 10, 1889, and there were no signs of any former inhabitants. In 1899 the island was leased to the Pacific Islands Co. There is no anchorage, but landing was effected on the lee side.

Shoal water extends from the north and south points, nearly 1 mile from the latter. The center is occupied by a brackish lagoon, about 1 fathom in depth. Some shrubs and also much driftwood was found.

A beacon has been constructed on this island. It has been placed on the chart at a distance of 1,000 yards northwest of its southern sandy extremity. It is conical, built of corrugated iron, 30 feet high, and surmounted by a flagstaff 15 feet in height.

The south point of the island is in latitude 3° 35′ 00″ S., longitude 171° 32′ 52″ W.

Enderbury Island, the western part of which is in latitude 3° 08′ 30″ S., longitude 171° 10′ 00″ W., extends 2½ miles north and south, and is 1 mile in width, the highest part being about 30 feet above the sea. This island is under the protection of Great Britain, and was leased to the Pacific Islands Co. in 1899.

A fringing reef of coral, which is steep-to, surrounds the island, extending from 100 yards to 200 yards offshore. Two small mangrove thickets and scattered patches of grass form the only vegetation. The center of the island is a salt-water lagoon, and quantities of decayed driftwood were found on the east side of the island.

There is no anchorage at Enderbury Island, no fresh water can be obtained, and landing is difficult.

Directions.—With winds to the northward of east sailing vessels should approach the landing round the north end of the island, and with the wind southward of east, round the south end.

Current.—The prevailing current in the vicinity of Enderbury Island is westerly, at about the rate of 1 to 2 miles an hour. When approaching make full allowance for this set, because if it swept past the island it may be found difficult to beat back against it.

Tides.—It is high water, full and change, at Enderbury Island at 5h. Springs rise 6 feet, neaps 3 to 4 feet.

Canton Island, the northern island of the group, lies about 32 miles 301° of Enderbury Island. It is under the protection of Great Britain, and was leased to the Pacific Islands Co. in 1899, but there were no inhabitants in 1907.

It has been called Mary, Swallow, and Mary-Balcout Island, and assigned various positions. The atoll is of coral formation, from 10 to 20 feet above the sea, and about 9 miles long, southeast and northwest. Coconuts have been planted in places, and inside the high raised beach is generally covered with brushwood.

The width of the land varies from 50 to 600 yards, inclosing a spacious lagoon; on the western side are several openings; they all dry except the southernmost, which, however, will only admit a boat; the interior of the lagoon is from 3 to 12 fathoms deep with numerous coral patches.

The tidal stream in the passage runs from 4 to 6 knots.

The surf breaks very heavily on the North Point, and on Pyramid Point, the south extreme, heavy tide rips extend at least ½ mile from the weather side of the island. A westerly current sweeps past the land, running at least 1½ miles per hour.

Anchorage.—There is anchorage in 10 fathoms close to the entrance of the lagoon on the west side.

With any chance of a westerly wind, no vessel should remain at anchor there, the anchor being dropped on a small bank only 400 yards from the beach. A ship was wrecked on the south side of the entrance of the lagoon.

Position.—The observation spot at a deserted hut on the south side of the entrance to the lagoon is in latitude 2° 48′ 53″ S., longitude 171° 42′ 35″ W.

Tides.—It is high water, full and change, at 5h.; springs rise about 4 feet.

McKean Island, about 67 miles 20° of Gardner Island, is reported to be charted 14 miles to far westward. It is of coral and sand formation, 25 feet high, ¾ mile long by ½ mile broad, and covered with bushes. This island is under the protectorate of Great Britain, and is leased to the Pacific Islands Co.

Winslow Reef is about 120 miles 346° of McKean Island. It extends 1 mile in a northwest and southeast direction and is ¾ mile broad, with two pointed rocks awash, latitude 1° 40′ S., longitude 174° 50′ W. This position must, however, be considered doubtful.

Baker Island (New Nantucket) is of coral formation, about 20 feet high and almost entirely devoid of vegetation, except patches of grass here and there; it is about 1 mile long east and west, ¾ mile wide north and south, surrounded by a reef 200 to 400 feet wide, and awash at low tide. There is no fresh water on the island, and it is leased to the Pacific Islands Co., under British protection.

The surf breaks heavily on the eastern end and southwest point, and there are heavy tide rips eastward of the island extending some distance from the land.

The center of the island is in latitude 0° 13′ 30″ N., longitude 176° 31′ 11″ W.

Winds.—The winds during the months May to October are from east to southeast, and blow steadily, but from November to April they are generally from east to northeast and are frequently interrupted by westerly winds and bad weather.

Howland Island.—This island, the center of which is in about latitude 0° 49′ 00″ N., longitude 176° 41′ 45″ W., is about 2 miles long north and south and about ½ mile wide; it is from 18 to 20 feet high, of coral formation, with the fringing reef. It is leased to the Pacific Islands Co., under British protection.

The British bark *Notero* is stated to have struck on a ledge of rocks extending 1 mile westward of the northwest point of the island. She was probably closer in; the reef is charted as extending ¼ mile off.

A clump or two of brushwood near the center of the island and a little grass on the ridge is all the vegetation it affords. Water is found by digging a few feet; it is slightly brackish.

It is high water, at full and change, about 7h. 11m.; rise 8 feet; the tides are regular and semidiurnal.

Ellice Islands.—This group of islands extends about 360 miles in a northwest and southeast direction and consists of nine atolls or clusters of islands, all of which are inhabited; they lie between the parallels of 5° 30′ and 11° 00′ S., and the meridians of 176° and 180° E.

The islands are all low and flat, the tops of the coconut trees being from 60 to 80 feet above the water.

The London Missionary Society have stations and teachers on these islands.

Hurricane.—In February, 1891, the Ellice Group was almost devastated by a severe hurricane. During the lifetime of the oldest inhabitant this is the only one which has occurred.

Current.—It is to be noted that when hove-to off the lee side of the islands in the Ellice Group, there is always so strong an equatorial current setting to the west that it is with great difficulty a sailing vessel can be kept near the land.

Nurakita, or Sophia Island, the southernmost of the group, is low, flat, and covered with dense bush, through which the branches of many dead trees protrude; it is about 1 mile long, east and west, and about ½ mile across. Above this bush one coconut palm and two or three other trees were to be seen.

The island is surrounded with a fringing reef, and a bank extends off it with 14 fathoms water, at a distance of 1 mile, and 8 fathoms at about ½ mile from the beach; outside the depth of 14 fathoms the water deepens considerably.

The center of the island is approximately in latitude 10° 45′ S., longitude 179° 30′ E.

The inhabitants have turtle, fish, and bananas, but the water is very bad. Landing is difficult, except in canoes.

There is anchorage off the southwest side of the island in 7 fathoms, with the left extreme bearing 48° and the right extreme 77°.

There is good anchorage also on the north side of the island in from 7 to 12 fathoms at 600 or 800 yards from the coast, even sandy bottom. A reef extends about 400 yards from the west point.

An irregular patch of coral was reported in 1900 extending for about a mile to the southward of the island on which a ship might find anchorage, but great caution would be necessary.

Reported banks—Rose Bank.—A large coral bank, upon which depths of 14 and 15 fathoms were obtained, has been reported, lying about 25 miles 156° from Nurakita Island, or approximately in latitude 11° 03′ S., longitude 179° 50′ E.; the bottom was plainly seen and appeared to be regular; no land was in sight from the masthead.

Kosciusko Bank.—An extensive bank on which was found a depth of from 16 to 18 fathoms, lying northward of Nurakita Island in (approximately) latitude of 10° 18′ S., longitude 179° 44′ E.

A strong current was setting westward over this bank.

Martha Bank of 14 fathoms is reported to have been sailed over by the American schooner *Martha* on October 24, 1889, from which Nurakita bore 223°, distant 9 miles, or in latitude 10° 40′ S., longitude 179° 35′ E.

Also, on October 28, 1889, when about 30 miles east of Nurakita, the *Martha* passed over a bank with several small detached shoals around a larger one with from 14 to 16 fathoms over them, the coral bottom being plainly seen. Latitude 10° 50′ S., longitude 180°.

Nukulailai, or Mitchell Atoll, comprises several islets situated on a coral reef which surrounds a shallow lagoon, extending about 6½ miles north and south and 2½ miles east and west. A fringing reef attaches itself to all the islands, which renders the landing from boats a hazardous operation; even the native canoes are frequently capsized. There is no passage for vessels into the lagoon, but a precarious anchorage may be obtained off the reef on the lee side in fine weather.

There is anchorage off Fangawa Island, the westernmost of the cluster, in 7 fathoms, 300 yards, from the reef. This bank is best found by eye from aloft, being easily seen with a good light.

A reef is reported to extend 600 yards from the northwest point, but no outlying reefs could be found.

The natives state that there are two boat passages into the lagoon, one in the northern and one in the southwestern part.

The population, under a chief, are all Protestants; they live at Fangawa. There is a station of the London Missionary Society here. Coconuts, bananas, fish, pigs, and poultry may be obtained.

There is water on Fangawa and on one of the small northern islands.

Fangawa is in latitude 9° 22′ S., longitude 179° 50′ E., approximately.

Tidal streams.—At the anchorage the flood sets south-southwest and the ebb to the northward.

Funafuti, or Ellice Atoll, consists of 30 islets, one of which only, Fúnafuti, the largest of the group, is permanently inhabited; the atoll in its major axis is 13½ miles in length in a north and south direction, with an extreme breadth of 10 miles. Toward the southern end it contracts to a breadth of little more than 1½ miles.

The depths in the lagoon in the deepest parts are from 24 to 29 fathoms over a sand and coral bottom. Numerous dangerous shoals and coral patches stud the lagoon, several of which break heavily in the swell which rolls in by the various passages. The western portion of the lagoon is especially foul and is full of small coral heads, rising steeply, with deep water all around.

Funafuti Island is situated on the east side of the reef, having a total length of 6¾ miles and a general width varying from 150 to 20 yards, except in the elbow formed by the trend to the westward of the southern portion of the islet, where the extreme breadth is 700 yards.

The village, Fongafale, consisting (in 1901) of 220 inhabitants, is situated on this elbow on the lagoon side.

The islands are under the British protectorate and ruled by a native chief. The inhabitants are a mild, inoffensive, happy, and contented race, and are much under the influence of the London Missionary Society's representative.

At the back of the village the elbow of land above mentioned is partly occupied by a lagoon or swamp, which fills and empties with the tide through subterranean passages communicating with the ocean underneath the beach, which forms its seaward margin. The beach is only a few yards wide in places. The whole island is densely covered with coconut trees and presents a very uniform outline when viewed from a distance; the most noticeable feature is a clump, 84 feet high, rising rather higher than the surrounding tree tops, close to the southwestern end.

In the broader parts of Funafuti there are several wells and water holes for bathing, but the water is neither very good nor very plentiful. The amount of rain that falls, however, prevents any real scarceness of water. Wood for fuel is abundant.

Fowls, pigs, fish, and coconuts are readily obtained from the natives, but bananas, taro, and breadfruit are scarce.

About 30 tons of copra are exported annually.

A succession of white traders have resided upon the island for many years past. The value of money is fully appreciated by the natives, the price of labor being 4 shillings per day, but certain articles of trade are accepted in lieu of money payment.

Borings.—In 1896 Funafuti was selected by a committee of the Royal Society as being a typical atoll in which to make deep borings for the purpose of throwing light upon the geological formation of atolls in general. Attempts were accordingly made, both on the lagoon side, at about ¼ mile to the southwestward of the mission house, and also on the edge of the beach on the seaward side at about 1 mile from the western end of the island; in both cases the borings had to be abandoned at depths of 100 and 70 feet, respectively, on account of the sand and bowlders that were met with and the porous nature of the formation.

In 1897, however, the attempt was resumed by the New South Wales Government, and a depth of 557 feet was reached by the month of September. By September, 1898, a depth of 987 feet was reached, and in April, 1899, a depth of 1,114 feet was attained; hard rock with casts of fossils.

Funamanu is a small narrow islet, 2.6 miles southwestward of the southwest end of Funafuti, covered with coconut trees 70 feet high, and situated on the western end of the narrow strip of reef which runs continuously from the latter island.

Upon this strip of reef lie two other islands, named Fatato and Funangongo, each about ½ mile in length, and similarly covered with coconut trees.

Beacon.—On the western end of Funamanu a whitewashed stone beacon, 10 feet high and 30 feet in circumference, has been built, to assist in recognizing the proper passage for entering.

Falefatu, 1 mile southwestward of Funamanu, is a small narrow islet covered with coconut trees. It separates Te Buabua Passage, to the northeast of it, from Te Ava Mateika, to the southwest.

A reef extends from the north and south extremes of Falefatu 450 yards and 300 yards, respectively, and a bank with 4 fathoms on it extends for ¼ mile in a southeasterly direction from the middle portion of the island.

Mateika, the north part of which lies 1¼ miles southwestward from Falefatu and forms the southwest entrance point of Te Ava Mateika, is the northernmost of a series of long narrow islands extending in a southerly direction to the southwestern extremity of the atoll. These islands and islets are all wooded and have extensive coconut groves upon them, and present a very uniform outline.

Motungie is a small islet resembling a haycock at the southwestern extremity of the chain of islets alluded to above and separated nearly 600 yards from the next island, Avalau, to the northwestward of it, from which another chain of islets extends for 1 mile in a northerly direction.

Tefala is a small islet on the reef forming the western side of the atoll, 1¾ miles westward of the north point of Mateika. On it (1896) is a remarkable single tree, the top of which stands prominently above those surrounding it, and forms an excellent mark.

Fuagea.—From Tefala the reef extends continuously to the north-northwestward, forming the western side of the atoll, for 1¼ miles to a small islet, Fuagea, and thence for 1½ miles farther to Te Ava Fuagea, a deep passage through the reef, which is about 200 yards in width at its narrowest part.

By entering the lagoon at this point, however, a vessel is led into the midst of such a cluster of rocks and patches, extending in all directions, that the passage should on no account be attempted.

There is another passage with 4 fathoms water in it ¾ mile farther to the northward, but this is not fit for a vessel, either.

Funafatu, the westernmost islet of the atoll, is situated 5½ miles 341° from Tefala, and lies near the outer edge of the reef, which here projects to the westward.

Te akau Fuafatu is a coral patch with 3 fathoms least water on it, lying 291° from Fuafatu, distant 1 mile. It rises from a bank of sand and coral with 6 to 7 fathoms on it, which projects for 1 mile to the westward from the reef. This bank is ½ mile in width, and falls down steeply to the 100-fathom line. With any swell the shoal breaks heavily, and the bank on which it stands also breaks occasionally.

Fualopa and Tebuka are small islands 1¾ miles 48° and 3¾ miles 43° from Fuafatu, respectively. Both islands are wooded, and present no distinguishing feature. Tebuka is the larger of the two.

Tebuka vili vili is a sand cay and lies on a small detached reef nearly ½ mile 223° from Tebuka. On each side of this sand cay there is a passage through the reef, but neither can be recommended for a ship. Nor were they sufficiently closely examined to justify their being attempted.

Te Afualiku, a sand cay with a small clump of coconut trees, is situated 1¾ miles 26° from Tebuka, the space between being so much encumbered with foul ground as to render a passage quite impracticable for anything larger than a boat.

Anchorage.—A bank with 5 to 8 fathoms water projects northward for ¾ mile beyond the line of the outer edges of the reefs between Tebuka and Te Afualika, northwest side of the lagoon, and which being under the lee, affords convenient anchorage in fine weather outside the atoll. Te Afualiku in line with Pava bearing 68° and the western extreme of Tebuka bearing 153° gives anchorage in 6 fathoms with plenty of room to swing.

Pava and Fualifeke are small wooded islets nearly joined at low water by sand, lying east-northeast and west-southwest of each other, and situated 1¼ miles 71° from Te Afualiku. Southwestward from Pava a tongue of reef stretches for 700 yards.

Mulitefala and Amatuku are two wooded islets lying close together, extending from ½ mile to 1 mile northwest from the north point of Funafuti.

Ship passages.—There are three passages into the lagoon that can be used by vessels, of which the northernmost, Te ava i de lape is the best.

Of the other two on the southern side, Te Buabua and Te ava Mateika, the former is to be preferred, but both are obstructed by patches immediately the sunken barrier is crossed, and caution is necessary in navigating.

The channels on the western side are not considered safe for large vessels, without artificial marks.

Te ava i de lape, between Te Afualiku and Pava Islands, is the northernmost and best passage into the lagoon. It is 1,600 yards wide between the points of reef on either side. There are two coral heads with least water of 3 fathoms on them in this pass. One lies with the coconut trees on Te Afualiku Island bearing 261° distant 900 yards, the other one is about 100 yards 241° from this position. The edge of the reef on the western side which projects for 200 yards from Te Afualiku generally shows well and is fairly steep-to. The deepest water is found toward that side of the channel, and the submerged barrier may then be crossed in 27 feet at low water, the depth gradually shoaling toward the eastern side when the 3-fathom line extends for ¼ mile beyond the tongue of reef stretching from Pava Island. The track recommended is shown on the plan.

The flood and ebb streams set southwest by south and northwest, respectively, through the channel, about 1 to 1½ knots per hour.

Te Buábua, between Funamanu and Falefatu Islands, is the best channel for entering the lagoon from the southeastward. Between the rocky spits extending for 350 yards and 450 yards, respectively, from the extremes of these islands, the navigable passage is 700 yards broad.

The deepest water is found nearly in mid-channel, but somewhat nearer Falefatu than Funamanu, and carries 24 feet at low water, but immediately inside is Fleming Rock with 2 fathoms.

These rocky spits do not invariably show well, and, moreover, the 3-fathom line projects for 550 yards beyond the end of the spit on the eastern side.

The whitewashed beacon on the western end of Funamaru renders the channel unmistakable.

Occasionally the passage breaks right across.

The flood and ebb streams set west and southeast by east, respectively, through the channel, about 1 knot per hour.

Te ava Mateika, southwest of Te Buabua, lies between Falefatu and Mateika Islands. The navigable passage between these islands is about 700 yards wide. A reef, which generally breaks, extends for 300 yards from Falefatu, and on the other side of the channel a narrow ledge of rocks and foul ground extends for 1,200 yards 32° from Mateika. The extremity of the ledge is not always clearly seen. In the center of the channel a depth of 27 to 30 feet may be carried through by following the pecked line.

The tidal stream sets, flood west-northwest and ebb to east-southeast, from 1 to 1½ knots.

The overfalls and tide rips are heavier in this channel than in either of the other two, and there are no leading marks. The rocky ledges on either side are fairly steep-to.

Dangers in the lagoon.—These are so numerous that no mere description would suffice, and reference to the chart is necessary.

Directions—To enter by Te Buabua Passage.—Approaching from the southward the beacon on the west end of Funamanu will be readily made out, and the different islands can then easily be recognized. Steering 349° to cross the sunken barrier rather nearer Falefatu than Funamanu, or at about 700 yards distant from the former, Te Afualiku, on the northwest side of the group, should be seen right ahead (it must be remembered that Te buka vili vili is similar appearance to Te Afualiku, both being sand cays with 3 palms). This bearing of the cay being preserved leads over the deepest water and passes 250 yards and 400 yards eastward of Flemming and Strickland Rocks, respectively.

If the staff and ball beacon[1] on Te ulu Bunga be in place, that patch may be passed on either hand; but if it is washed away (as is very likely to be the case), then, on aproaching the bar, as the southeast extreme of Funafara closes the eastern extreme of Falefatu alter course to 16° to bring that transit on astern, which leads between Te ulu Bunga and Waugh Rock. The latter will be given a wider berth by shutting the distant object in a little when approaching it.

Having passed Waugh Rock, a course 62° leads up to the anchorage off the Mission House at Fongafale.

To enter by Te ava Mateika.—Fixing the ship carefully by bearings of the islands, approach the channel on a 344° course, passing 700 yards southwestward of Falefatu, which will lead midway between Lowis Patch and Brewis Rock after crossing the sunken barrier. When the southern extreme of Funamanu touches the southern extreme of Funafuti, bearing 60° Montungie Islet should just have opened to the westward of Mateika Island, and a 17° course will keep the transit open and pass midway between Dawson Patches and Te ulu Bunga.

To enter by Te ava i de lape.—From a position with Te Afualiku in line with eastern extreme of Te buka, 204°, and the southern extreme of Pava touching the northern extreme of Mulitefala, 96°, steer 166°, which leads across the sunken barrier in 27 feet water, until Te Afualiku bears 318°, when keep it astern on that bearing. This course will lead ½ mile northeastward of Te akau Tuluaga and Te akau Fasua, both of which reefs should be plainly visible.

When the end of the sandy beach north of the Mission House at Fonga fale bears 95° steer for it on that bearing, passing Te akau Asano on the port hand at a distance of 400 or 600 yards.

Shoals.—**Te akau Kalea** is the northernmost of the line of small detached coral reefs fronting the shore, abreast the anchorage off Fongafale. It is about 150 yards in extent, with a few coral heads that just show themselves at low water with depths of 1 to 2 fathoms between them.

Beacon.—A staff and diamond is fixed in the coral in about 2 fathoms water, marking its northern edge, and is a very useful guide to the anchorage. No dependence, however, can be placed upon its permanency. The coral reefs to the southward and south westward frequently break when any swell sets into the lagoon. The westernmost of these dangers is a rock awash, situated 1,800 yards 228° from the beacon on Te akau Kalea, with the western point of Funafuti bearing 200°, distant 1 mile.

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[1] Te ulu Bunga beacon, if in place, would be in line with Te Afualiku, but it was not there in 1902 (*Pylades*).

Te akau Tafauri is a small coral patch with 8 feet on it and deep water around. It is situated 600 yards 347° from Te akau Kalea, the anchorage being nearly midway between them.

Fongafale anchorage.—Coral reefs and patches front the shore within the 10-fathom line to distance of 1,100 yards abreast the Mission House at Fongafale, but good anchorage may be obtained in 9 fathoms, sand, northward of these reefs, with the end of the sandy beach immediately north of the village bearing 175° and the beacon on Te akau Kalea bearing 178°, distant 250 yards.

A small vessel may anchor closer to the Mission House in 7 fathoms, at 300 yards 91° from the beacon.

Current.—The currents outside the lagoon in the vicinity of the atoll and to a distance of 7 or 8 miles from it in all directions were continually observed while sounding around the atoll. In no case was the rate found to exceed three-quarters of a knot and seldom more than one-quarter to half a knot per hour. The general set was to the westward, taking a northerly direction on the northeastern side of the atoll.

The rate being so insignificant, it is almost impossible to separate the effect of the wind and tidal influences upon the normal direction.

Tides.—It is high water, full and change, at 5h. 20m.; springs rise 6¾ feet, neaps 4¾ feet.

In the center of the lagoon the tidal streams are weak and irregular, but in the passages through the reef the flood and ebb streams run with a strength of from 1 to 1½ knots per hour to the northwestward and southeastward, respectively.

Datum.—The tidal datum is a bench mark $\overline{/\,|\,\backslash}$ cut on the southwest angle of the mission church, Fongafale; it is 13 feet 7 inches above the level to which the soundings on the chart have been reduced. The zero of the tide pole was 16 feeet 7 inches below the bench mark. Mean sea level is 10 feet 2 inches below the bench mark.

Climate.—From May to August, 1896, the lowest temperature recorded was 75° and the highest 90°, the average shade temperature being 83°.

A great deal of rain fell during the month, hardly a week passing without more or less rain, and occasionally it would pour the whole day. The wet and dry bulb thermometers were seldom more than 3° apart.

The readings of the barometer ranged between 30.16 and 29.90 inches.

Position.—The observation spot at Fongafale is in latitude 8° 31′ 05′ S., longitude 179° 12′ 37″ E.

Nukufetau, or De Peyster Atoll, comprises a group of islets situated on a reef about 24 miles in circuit. The principal village is on the west side of the reef near the entrance to the lagoon, and the whitewashed church, school, and native teachers' houses are only visible from the north and west side of the group.

The population in 1901 was 276.

Position.—The south point is in latitude 8° 04′ 02″ S., longitude 178° 28′ 50″ E.

There is a good ship channel into the lagoon on the northwest side 670 yards wide, with 4 to 5 fathoms water, at about 400 yards northeastward of Sand Islet. There may be better water off the line of soundings shown.

The tidal stream in the channel was formerly said to run out of the lagoon at the rate of from 4 to 5 knots, but during the stay of the British naval vessel *Pylades* in 1900 it was not more than 1 knot. In order to maintain a mid-channel course, keep on the northern side of the entrance, as both flood and ebb streams set to the southward.

Anchorage.—Inside the lagoon the anchorage is good in many places; the navigation is, however, somewhat intricate.

British naval vessel *Royalist* in 1898, entering the lagoon with good light, anchored off Coal Island, and, hauling her stern close in, took in 25 tons of coal.

Directions.—From a position with Sand Island bearing 150° and the southeast extreme of Coal Island 77° steer 99°, which will lead over the sunken barrier in a depth of 4 fathoms.

When the islet on the northwestern part of the atoll appears midway between Entrance and Coal Islands, bearing 32°, steer 212° until Sand Island bears 353°, when bring that island astern until the white stone beacon at the village bears 234°, when good anchorage will be found in a depth of 10 fathoms, with 300 yards swinging room.

Vaitupu, or Tracy Island, is densely wooded and surrounded by fringing reef.

Vaitupu has two lagoons, a small one at the northern part and a larger one at the southeastern, the latter having two entrances, one of which is practicable for boats at high water. There is a small islet situated in the entrance.

The south point of the island is in latitude 7° 30′ S., longitude 178° 41′ E.

Anchorage.—There is anchorage in 7 fathoms near the village, situated ¾ mile 324° of the south point of the island, about 130 yards from the reef, with the single-roofed church bearing 21° and the extreme of the trees on South Point 108°. By keeping the trees on the same bearing and bringing the church to bear more easterly, anchorage may be obtained in 17 fathoms further off the reef. There is no other anchorage for a vessel off the village.

Supplies.—There is a large well in the center of the village. The water is, however, a little brackish. Coconuts, taro, ducks, pigs, and fowls can be obtained; copra is the only export.

Landing is difficult and best effected in the native canoes.

Winds.—The island is subject to violent storms in December, which do considerable damage to the coconut trees.

Nui (Netherland or Egg Atoll), lying 90 miles 285° of Vaitupu, is in the form of a crescent, the northwest and southwest horns of which are joined by a long connecting reef through which there is no passage.

On the eastern side are eight islets, two of which, the southwestern (Fanutapu) and northern (Nui or Tnaguinui), are premanently inhabited, having 306 inhabitants in 1911.

There is no safe anchorage off this atoll. Landing is dangerous after half ebb, even for canoes, but at all times for boats. There is no entrance to the lagoon.

The island produces coconuts, taro, pandanus, breadfruit, bananas, fowls, and pigs. About 70 tons of copra are exported annually.

The south point is in latitude 7° 15′ 45″ S., longitude 177° 10′ 00″ E.

Anchorage.—Temporary anchorage is reported to be obtainable near the shore, with the west extremity of Fanutapu bearing 55°.

Caution.—Some of the fish here are poisonous.

Niutao (Speiden or Lynx Island) is about 1¼ miles across, nearly round, and densely covered with coconut trees. A narrow fringing reef extends all around the island, on which a heavy surf breaks, rendering landing difficult except for canoes.

There is no anchorage, and no passage into the lagoon.

A small quantity of brackish water, which filters into wells at high tide, is the only water on the island. The people are quiet and inoffensive. The village is on the southwest side of the island. Pigs and fowls are plentiful. The best landing place is close northward of the west extremity of the island.

The church at the southwest part of Niutao Island is in latitude 6° 06′ S., longitude 177° 16′ E.

The population in 1907 was 620; they use cloth made of native fiber almost entirely for their clothes, the village was well designed and beautifully kept, and several of the houses were built of coral.

The *Pylades* experienced a strong southerly set between Nukufetao and this island.

Nanomana, or Hudson Island, is a low coral island, surrounded by a narrow fringing reef with an unusually precipitous face to seaward, lying 55 miles 257° of Niutao Island, and landing is difficult.

The island is 1½ miles long, north and south, and nearly 1 mile wide, but affords no anchorage, and there is no entrance to the lagoon.

Reefs extend nearly ½ mile from the north and south points, on which the surf breaks heavily.

The island had 329 inhabitants in 1911, and the coconut trees render it visible for 8 or 10 miles. The village is on the west side, and the native missionaries are established here. Coconuts, taro, and fowls can be obtained, also good water from wells.

The village is in latitude 6° 18′ S., longitude 176° 20′ E.

The master of the steamer *Titus* reports the existence of a bank with 7 fathoms over it, situated at a distance of 2 miles 12° from the north point of Nanomana Island; the bank, on which rollers were observed, is about ½ mile long in a northeast and southwest direction and 400 yards broad.

It is placed on the charts in latitude 6° 15′ 30″ S., longitude 176° 20′ 30″ E., and marked P.D.

Grand Cocal Shoal.—It has been reported that there is an extensive shoal 3 or 4 miles in circumference, somewhere between Nanomana and Nanomea Islands, with from 5 to 7 fathoms water, on which the sea breaks in heavy weather.

The British naval vessel *Miranda* (1886) passed over the eastern part of the position assigned to this shoal, but no soundings were obtained, nor was any discolored water seen. The British naval vessel *Torch* (1904) also found no sign of it, and its existence is doubtful. It is marked P.D. on the chart.

The natives of Nanomana and Nanomea Islands deny its existence.

Nanomea, or St. Augustine Atoll, the northernmost of the Ellice Group, consists of a coral reef of an extended crescent form, about 6 miles in length, with the two principal islets, Lakina and Nanomea, respectively, on the northwest and southeast horns. Reefs extend ½ mile off the southeast and northwest extremes.

Anchorage can be obtained in a depth of 7 fathoms on a narrow coral spit close off the village.

There is a village on the western side of the southeast islet, off which extends a broad fringing reef springing up as a wall of coral from the depths of the ocean; on this the sea breaks furiously; at intervals the surf, it is said, subsides so as to allow boats to land.

There is a Samoan missionary here and the people are friendly. There is a population of 730.

Winds.—Light westerly winds were experienced in May. This fact shows that it is not advisable to take up an inshore anchorage on the west side of any of these islands at this period.

The Gilbert or Kingsmill Archipelago extends from latitude 2° 45′ S. to 3° 45′ N. and between longitude 172° 30′ E. and 177° 15′ E., within which area is included 16 groups of islands.

NOTE.—These islands are more or less incorrectly placed as regards the longitude; a note is placed against those known to be in error.

Supplies.—The food of the natives of the Gilbert Islands consists of coconuts, fish, and an inferior kind of taro, the latter being used as a luxury. There is no fresh water, that used by the natives being brackish. Few supplies can be obtained at these islands except coconuts.

Winds.—The trade wind, accompanied by fine weather, prevails from May to September, blowing from east-northeast to east-southeast, with occasional showers. During June the weather is hot and dry and the wind light.

From October to April variable winds from the northward and westward are experienced and much rain falls. Violent gales of the revolving character sometimes occur from southwest; these storms last from 2 to 3 days, shifting gradually to the northward.

Currents.—The currents among these islands are very irregular and uncertain, as it is in this vicinity that the equatorial current turns back at the counter current; usually the set is westerly south of the Equator, and easterly in north latitude.

In July, 1883, on the Equator, in longitude 175° E., a current of about 2 or 3 knots an hour ran to the eastward for 14 or 15 days, although the wind was then fresh from the eastward.

In January, 1884, the current was running to the eastward at a rate of 1¼ miles an hour between Apamama and Makin Islands.

Capt. Wilkes says: "On our route to the northward we crossed a stream setting to the westward, which extends as far westward as the Kingsmill Group, between latitude 2° S. and 3° N., after which we encountered another, setting with equal velocity to the east, between latitude 4° and 9° N.; but Horsburg and several other authorities mention the prevalence of an easterly current as far to the west as the sea of Celebes, and particularly in latitude 4° N."

Earthquakes are occasionally experienced. The direction of the oscillations seems to be from the southwest.

Tides.—It is high water at full and change throughout the group at 4h.; and springs rise about 6 feet.

Arorai, or Hurd Island, the southeastern of the group, is about 4 miles long northwest and southeast, and 2 miles broad, it is low, 15 feet, and has little vegetation on it.

Anchorage may be obtained on the west side, about 100 yards from the reef, with the church in the northern village bearing 54°, but it is too close in for anything but small vessels.

In fine weather boats can land on the reef opposite this village.

A reef which breaks extends 600 yards southward of the island; and a bank of sand and rock extends about 2 miles off the north end, with depths of 2½ fathoms at its extreme, which does not always break.

The population of the island in 1901 was 1,050, all Christians. Fish, poultry, and coconuts can be obtained.

It is reported to be situated 3 miles westward of its charted position.

Tamana, or Rotcher Island, lying about 55 miles westward of Arorai Island, is about 3 miles long and ¾ mile broad, with a fringing reef extending about ½ mile from the north and south extremes, and from the coast on the eastern side; on the southwest or lee side there is deep water close to the shore.

The western shore forms a bight about ½ mile deep; there is a similar anchorage to Arorai. Landing can only be effected at low water.

Current.—Off Tamana Island the current sets as much at time as 2 knots an hour to the west-southwest.

Onoatoa, or Clerk Atoll, lies about 35 miles 330° of Tamana Island. It is described as 12 miles in length, having a lagoon bordered by a broken reef on the western side, with a good boat channel near the center. At low water it is possible to walk from Teumah round the whole group to Taburari. Landing can be effected at Teumah at all times. About 100 tons of copra is exported annually.

There is anchorage in 16 fathoms about 400 yards from the reef on the northwest side of the atoll, with Teumah Island bearing 26° distant 670 yards, but there is hardly room enough to swing; also anchorage inside the northwest point in 6 fathoms, with the center of Teumah Island bearing 1°; east extreme of Tanyah Island 96°.

The chart shows a beacon at Teumah.

Boats can cross the reef into the lagoon, which is, however, shallow.

The navigating officer of the *Pylades* reports that this island is 5 miles north of its charted position and considerably out in bearing; caution should therefore be used.

Beru (Peru) Island, or Francis Atoll, about 36 miles 31° of Onotoa Island, 11 miles in length northwest and southeast from ½ to 1½ miles in width, 6 to 8 feet in height, and thickly covered with coconut and pandanus trees; it is surrounded by reef, and has a small lagoon on the west side. There is no entrance into it except for boats. Three beacons were erected in 1901 to mark the south side of the boat channel, they are of dark stone with staves at the top. A staff and ball beacon, erected by the *Pylades* marks the entrance. Near the center of the island the reef is 2½ or 3 miles from the land.

The best landing is about 1½ miles from the south point of the island, opposite the church and trading station.

The island is governed by a chief and council. About 90 tons of copra are exported annually. The population in 1901 was 2,309. A European missionary and his wife were in charge of the London mission station. A few of the fish here are poisonous.

The fishery islet near Espiegle anchorage is in latitude 1° 20′ 59″ S., longitude 175° 58′ 20″ E. The island is reported to be situated 3 miles eastward of its charted position.

Espiegle anchorage is on the west side of the atoll, northward of the most western point of the reef. There is a depth of 5 to 7 fathoms about 300 yards from the reef, with the northwest point of the atoll bearing 341° and the southwest point 113°.

The *Pylades* anchored about 50 yards from the edge of the reef in 15½ fathoms with the extremes of land bearing 107° and 341°.

The bank is very steep. When coming from the southward, care must be taken to avoid a shoal extending from the west point of the reef.

Nukunau, or Byron Island, about 29 miles 88° of Beru Island, is of coral formation, and surrounded by the reef common to these islands; it is 8 miles in length, northwest and southeast, from 6 to 8 feet high, from ¼ to 1½ miles in width, and thickly covered with coconut and pandanus trees, which can be seen about 12 miles.

The northern village is situated about 2 miles from the northern end of the island. A white wall surrounding the prison a few hundred yards south of this village is a conspicuous mark.

There is an anchorage in 10 fathoms, sand and coral bottom, about 1 mile northward of the south point, the bank being steep; this anchorage is impracticable except with a northerly or easterly wind. Landing is difficult with boats except at high water.

Anchorage has been reported on the west side of the island in 10 fathoms, 3 miles from the northwest point, with swinging room for a small vessel opposite a small village, where there is a boat landing through the reef. It is, however, considered that there was no secure anchorage for large vessels.

The south point of Nukunau is considered to be in latitude 1° 24′ S., longitude 176° 26′ E. (approximate).

Tapeteuea, or Drummond Atoll, lies about 37 miles 313° of Onoatoa; this atoll is 30 miles long in a northwest and southeast direction, and is thinly covered with pandanus and coconut trees.

On the lee or west side a barrier reef lies 5 or 6 miles from the shore inclosing a lagoon, the average depth in which is 5 fathoms.

The reef off the southeast point of this island is reported to extend 12 miles to the southward, and is therefore very dangerous, several vessels having struck upon it, and one or two have been lost there.

Neutilus Shoal is said to exist in the position 9 miles 226° from the southeast extreme of Tapeteuea, to have 5 to 12 fathoms over it, and to be connected with the reefs of Tapeteuea by foul ground. It is probably a part of the reef just mentioned.

There is good anchorage off the south end of the atoll, near the small island with trees on it; also about 2 miles to the westward, where there is a passage about ¼ mile wide with a depth of 2½ fathoms into the lagoon. The anchorage off this passage is in 15 fathoms, about ½ mile from the reef. About 2 miles westward of this passage is a sand bank, which dries at low water.

Peacock Anchorage is a bank of coral and sand, outlying the shore reef, upon which there is good anchorage in from 5 to 10 fathoms westward of Eanikai, the northern island. Great care must be taken when coming to an anchor here as the water shoals very quickly from 25 fathoms.

Rocks.—A patch of rocks, about 800 yards in extent north and south, and on which a depth of 2½ fathoms was obtained (although probably there is less water), lies in the southeastern part of Peacock anchorage.

From these rocks, locally known as Horses' Heads, the sand bank on the reef bears 121°, distant ¾ mile; and the west extreme of Utiroa 338°.

The American schooner *Heszeltine* is reported to have struck on a rock having 4 feet over it, about 100 yards 133° from the anchor shown on the plan, or where 4 fathoms was formerly charted.

The British naval vessel *Pylades* anchored in 8 fathoms with the northwest end of the land 341°, and the sand patch covered at high-water springs, 127°.

It is recommended for sailing vessels to anchor in not less than 17 fathoms, about 400 yards outside the first break in the reef, where there is a fair anchorage on fine sandy bottom, when the wind is to the eastward of south. This enables a ship to stand out to sea clear of the north reef in case the wind should shift to the westward, when it would no longer be a safe anchorage.

There is a fair landing at Peacock Anchorage in moderate weather.

The population are Protestants. About 150 tons of copra are exported annually. There are mission stations here, also several trading stations.

Supplies at this island are scarce and no water is procurable.

The north point of the group was found to be in longitude 174° 39′ E., and the reef off it is reported to extend farther westward than charted.

Nonuti (latitude 0° 40′ S., long. 174° 28′ E.) (pronounced locally Nonutch) or Sydenham atoll, situated 23 miles northwest of Tapeteuea, is 24 miles in length in a northwest and southeast direction by 10 miles in breadth, inclosing a lagoon. The atoll is partially covered with pandanus and coconut trees; the islets or which it is composed are nearly continuous and connected by coral reef.

From the north point a reef extends 1½ miles to the northwestward, and thence southward for nearly 9 miles to Archer entrance, southward of which is the extensive Auteken Spit.

There is a ship channel into the lagoon, having a least depth of about 4 fathoms, leading to the trading stations. The navigation of the lagoon is intricate.

The Flagstaff at Temaraia trading station on Matan is in latitude 0° 40′ 02″ S., and longitude 174° 27′ 33″ E.

The population on June 30, 1902, was 2,991; the foreign population consisting of 4 traders and 5 members of the Roman Catholic mission at Umantewena. There is a hospital at the mission, and a leper hospital on Temotu.

Produce.—About 200 tons of copra and 2 tons of sharks' fins are exported annually.

Conspicuous objects.—The thick clump of coconut trees on Temotu which makes as an island, and is conspicuous from all directions, a white stone ruin on a rock northwest of Temotu, the bell tower of the Roman Catholic mission at Taboiaki, which is a white skeleton tower, a gap in the trees about a mile north of Matan, and Numaton Island, standing on the northwest reef, is also conspicuous when off the western reef.

Southwest Anchorage.—Anchorage may be had outside the reef, to the northwestward of Temotu, off the small boat passage in 17 fathoms with the Roman Catholic mission bearing 20° and the ruin 134°. Steamboats should use the northern of the two boat passages, and a good lookout must be kept for rocks which are very numerous.

Autaken Reef, at the southwest side of the group, is nearly awash, steep-to, and always shows well. There are two fishermen's huts on it, but they are liable to be washed away.

Autaken Spit is an extension of the reef to the southwestward. It is always covered, light in color, and easily seen. From this spit the sunken reef trends north-northwest for about 6 miles to Archer entrance. On this reef are numerous small pinnacle coral heads locally known as "Horse's head," which are very difficult to see, and this part of the reef should be avoided in consequence.

Archer Entrance.—**A ship channel** leads through the reefs to the anchorage about 1½ miles from Temaraia trading station on Matan Island, but it is very intricate, and should only be attempted under very favorable circumstances of sun and weather, and the vessel must be conned from aloft; if possible, it should be near low water.

Beacons.—There are eight beacons erected on the reefs in the ship channel. The outer one Nateguk (a pole surmounted by a diamond) in line with the Gap north of Matan, bearing 73°, leads toward the break in the reef in the clearest water. A beacon stands on the south point of Tipaurao sand bank. The next five beacons should be left on the starboard hand, and the last (Tebebentau Reef) on the port hand, and this also indicates the anchorage. Notwithstanding the existence of these beacons the channel must be navigated by eye.

Tides.—It is high water, full and change, at 4h. 15m. Springs rise 6½ feet, neaps 5 feet.

Outside the lagoon the streams run with greater velocity, and follow the trend of the reef, the flood setting to the northward and the ebb to the southward at the rate of 1½ to 2½ knots per hour. The stream turns about one hour after high and low water.

Aranuka, or Henderville Atoll, lying 6 miles eastward of Kuria Island, comprises two islets on a reef 6 miles long east and west and 5 miles wide at the east end, diminishing to about 1 mile at the west end.

A reef extends 2 miles beyond the west point and along the north side for about 5 miles.

There is said to be anchorage on the above-mentioned reef, but there is much swell; there is also anchorage in 8 to 10 fathoms coral at 200 to 600 yards from the reef immediately southward of the boat passage on the southwest side.

There is a passage into the lagoon for boats only from half flood to half ebb tide, and, in moderate weather, in the middle of the southwest reef.

No water or supplies are obtainable.

The west point of the west island is in latitude 0° 11′ 10″ N., longitude 173° 32′ 40″ E.

Kuria, or Woodle Island, is about 4 miles long northwest and southeast. Its greatest width is 2 miles and is nearly divided into two islands near the center.

A reef extends from the north end nearly 3 miles in a northwesterly direction and has an average depth of 7 fathoms. This reef is said to extend about 2 miles farther west, with depths of 6 to 10 fathoms on its south and western edges.

Kuria Island, from 6 to 10 feet high, is thickly covered with coconut, pandanus, and other trees, and affords wood, water, coconuts, and a coarse taro.

There is an anchorage off the southwest point, also off the gap between Oneaka and Kuria in about 11 fathoms.

The north extreme of the island is in latitude 0° 13′ 53″ N., longitude 173° 24′ 30″ E.

In June the current was observed to be running 2 knots an hour to the westward, but close to the shore it changes with the tide.

Apamama, or Hopper Atoll, situated 13 miles northeastward of Aranuka Island, is 12 miles long northwest and southeast and 5 miles wide; the land is almost continuous on the north and east sides.

There are no European or Chinese traders on the island. The population in 1901 was 1,111 and decreasing. The houses and roads are kept in very good condition. The government of the island is in the hands of a council under the superintendence of the commissioner, the King having no part in it.

Coconuts, pandanus, and fish can be obtained. About 200 tons of copra are exported annually.

The sand cay northwest of Entrance Island is in latitude 0° 20′ 54″ N., longitude 173° 51′ 14″ E.

There is anchorage near the center of the western side in an opening in the reef 2 miles northward of Abatiku Island, forming the west point of the atoll.

This opening is about 1 mile wide and has a least depth of 2½ fathoms; it is not to be recommended as a passage into the lagoon, except possibly for boats.

South Passage, on the southwest side, is a good one. It may be easily recognized from the southward by Entrance Island (with two flagstaffs on it), which forms the eastern side of it.

Vessels drawing more than 15 feet of water should not attempt to enter the lagoon.

This passage, 600 yards wide, has an average depth of 5¼ fathoms, having some knolls of 3¾ fathoms and possibly less water on them; the western side shoals gradually to the main reef, rendering it difficult to distinguish the shallow water, especially upon the ebb tide, when the water is much discolored.

No course can be given for entering the lagoon; the eye is the best guide to avoid the numerous patches, and even the native pilots have no fixed course.

After rounding the sand spit northward of Entrance Island, steer about 146° to leave a reef on the port hand; when clear of this reef steer 31° for the anchorage off the town. There are some patches near the anchorage, but they can be seen from aloft with a good light.

Tides.—It is high water, full and change, at 3h. 30 m. In South Passage the rise of the tide was observed to be 6½ feet, the flood stream setting northeast and the ebb in the opposite direction 3¾ knots per hour.

Maiana, or Hall Atoll, lying 52 miles 301° of Apamama, is quadrilateral in form, 9 miles long northeast and southwest and 6 miles broad. The northeast and southeast sides are continuous, while to the southwest and northwest it consists of coral reef, in some places awash. There are boat passages into the lagoon from the west side, as shown on plan.

The western sides of the atoll are dangerous, and must be approached with caution, as the sea seldom breaks and the discoloration of the water is not always to be observed.

There is anchorage off the boat passage at the northwest end of the island in 15 fathoms, sand and coral, with the northwest extreme of Maiana bearing 54° and Bikerei Islet 113°. There are anchorages at all parts off the northwest side of the reef, avoiding the foul ground which stretches off 400 or 600 yards beyond the western elbow of the reef.

There is no anchorage except for small craft very close to the reef off the south point of the atoll.

About 80 tons of copra are exported annually. There is an American mission station here.

Bikerei Islet, near the north end of Maiana, is in latitude 1° 00′ 20″ N., longitude 173° 00′ 45″ E.

Tarawa, or Cock Atoll, 19 miles north of Maiana, is 18 miles in length north and south, and 13 miles broad east and west at the south end, tapering to a point toward the north.

Tarawa Atoll is partially wooded, having several groves of coconut trees and a dense undergrowth.

No water or supplies are obtainable.

The west point of Bitutu, at the southwest elbow of the atoll, is in latitude 1° 20′ 33″ N., longitude 172° 55′ 30″ E. A coral reef extends about 1 mile westward of this island.

The master of the schooner *Polenia* reports under date of July 17, 1914, having observed what was apparently a pinnacle rock about 70 feet in extent with the sea lifting over it eastward of Tarawa Island, in (approximately) latitude 1° 00′ N., longitude 174° 44′ E. The vessel was brought to the wind and the mate sent away to sound, but was unable to locate from the small boat. From aloft the discoloration and lift of the sea was plainly visible.

Barrier Reef.—The greater part of the reef on the west side is sunken, having from 2 to 10 fathoms on it; the land on the south and east sides is nearly continuous. Reef extends about 1 mile westward of Bitutu Island, the southwestern island of the group. This island has three hummocks, which appear like islands in the distance; there are also several small sand banks connected by the same reef.

The southeast extreme of the atoll should be given a wide berth, as a strong current splits off this point, one part flowing north, the other west.

Anchorage.—There is a fair anchorage in about 9 fathoms at the north end of Tarawa, off Lone Tree Islet, a small sandy island on the reef, with two trees on it. Also westward of Bitutu Island Reef is about 10 fathoms, at about 800 yards from the reef.

Lagoon Entrance—Anchorage.—At 3½ miles northward of the west point, or Bitutu Island there is a good passage over the reef in 4½ fathoms. See plan on which is dotted the recommended track from the entrance to the anchorage off the commissioner's house.

Directions.—From the southward, and having given a wide berth to Bitutu Island Reef, steer to bring Bikeman Islet beacon, painted red and surmounted by a triangle, 40 feet high, in the lagoon, 107° which, being steered for, will lead through the entrance. The passage is winding and about 200 yards in width, and has 4½ fathoms water in it; depths of from 13 to 19 fathoms will be found ¾ mile outside the entrance between the reefs. It is advisable to employ a native pilot.

Just inside the entrance to the lagoon there is a shoal which can be passed on either side. (The shoal of 4 fathoms seaward of the buoy is probably meant.)

The navigating officer of the British naval vessel *Torch*, 1905, reports that a red buoy was laid down by that ship on the outer 2½-fathom patch situated 2½ miles 7° from the outer leading beacon, but it is not likely to remain there for any time.

It should be left well to port by vessels entering the lagoon.

The British naval vessel *Pylades*, in 1902, erected two beacons about 400 yards east of the pier on Bitutu Island, these in line 183° lead up to the anchorage from westward of the buoy above mentioned. These beacons were still in place in 1907. A buoy with spherical topmark marks the rock, with 1½ fathoms, lying 28° about 1 mile from the flagstaff.

There is anchorage with the extremes of Bitutu Islet bearing 223° and 181°, and Bikeman Islet 87°

The water in the Tarawa Lagoon, especially during ebb tide, was found to have some substance in suspension which made it very thick, and in consequence coral heads were not easily seen.

Steamers sometimes lie at Tarawa waiting to proceed to Ocean Island for phosphate.

Apaiang, or Charlotte Atoll (lat. 1° 50′ N., long. 173° 00′ E.), lying 6 miles north of Tarawa, is 16 miles long in a northwest and southeast direction, with an average breadth of 5 miles.

On the northeast side the land is covered with coconut and pandanus groves, the northwest and southwest sides are reefs, with a few islets on them. There are several trading stations.

The principal village is Koinawa; it is beautifully kept and possesses the finest Manaiapa (government) house in the islands. The houses are of a sperior kind, being raised off the ground and kept very clean.

There is a king, but the council carry on the government under the commissioner.

The population in 1901 was 2,359.

Liliu Anchorage is reported to be available for any sized vessel, with plenty of room to swing. It is situated northwestward of Nanikirata, the western island of the atoll.

Channels to the lagoon.—There are two ship channels and four boat passages into the lagoon, all on the western side. The lee or northwest channel is north of a thickly wooded islet named Terio. The channel is from 200 to 400 yards wide, with from 2 to 5 fathoms water at low tide. The course in is about 99°; the eye, however, is the only guide through these passages.

There is good anchorage outside this channel in from 6 to 8 fathoms water, sandy bottom. This channel is used principally by traders going out, as they have a fair wind through it.

Bingham Channel is the main ship channel and is used by all vessels entering the lagoon; it is 1¾ miles southeast of Lone Tree Islet, a sand bank on the reef, having near its center a single tree.

The passage is about 200 yards wide, with from 2½ to 5 fathoms water; of course in is 32°, the eye being the only safe guide. The passage is marked by the reefs, bare on both sides at low tide, and on the east side there is also a ledge of rocks, which are generally uncovered, except at the highest spring tides. (A cay with a tree on it is charted in this position.)

There are several coral rocks on the inner edge of the reef on either side of the channel, having about 8 feet on them at low water; they can be seen from aloft when the light is favorable, showing dark green spots on the water. The deepest part of the channel is on the eastern side.

There is good anchorage both outside and inside this passage, in from 8 to 12 fathoms water, sand and coral bottom.

Supplies.—The productions of Apaiang are the same as on the other islands of the group. Fish are plentiful, and can be procured from the natives at a fair price; the water is brackish and unfit for consumption.

Iku or Lone Tree Island is in latitude 1° 46′ 18″ N., longitude 172° 57′ 00″ E.

Maraki, or Matthew Atoll, lying about 17 miles 65° of Apaiang, is 5 miles long north and south, and 3 miles broad at the south end.

There is an American mission station here, also several trading stations.

The north point of the atoll is in latitude 2° 01′ 30″, longitude 173° 20′ 00″ E.; numerous tide rips were observed off it.

On the west side of this atoll, about 1½ miles from its southern extremity, a boat passage into the lagoon is reported, but it can only be used at high water spring tides.

The most conspicuous object is on the west side of the island, the white house of the native missionary, in the village Elau wa nawi.

There is anchorage in 14 fathoms off the northwest village; this anchorage is very close in shore, without room to swing, and unsafe without having steam ready. There is good landing here through a deep cut in the reef.

The fringing reef extends about ¾ mile from the northwest point of the atoll, which is farther than anywhere else.

Makin (Taritari or Butaritari) extends 11 miles east and west. The south side is a continuous grove of coconut and pandanus trees with some undergrowth, the north side is unbroken reef, and on the west side are five passages into the lagoon, the southernmost of which is the deepest.

Entrance Island is on the north side of the entrance of the lagoon.

Directions.—It is advisable for sailing vessels to approach the island from the eastward, on account of the current, which sets generally to the westward, unless there have been strong westerlies blowing, and to keep well in to the shore making for the entrance passage.

The entrance to the lagoon is between a breaking reef 700 yards southward of Entrance Island, and the reef extending northward from Passage or Flink Point, and should be approached on a northeast bearing. To enter, pass about 150 yards southward of the "breaker," where 13 fathoms will be found, and when abreast of it, steer 53° between a line of reefs; the channel is about 600 yards wide, and in the center of it, ½ mile from the "breaker" there is a 2 fathoms patch which was marked by a beacon. This should be kept slightly on the starboard bow and closely rounded and left on the starboard hand, then steer 86° for about 800 yards, when the beacon erected on a patch awash on the edge of the reef north of the wharf will bear 154°, steer for the beacon on that bearing, following the dotted line on the plan, anchoring about ¾ mile north of the wharf in 10 fathoms.

A good light is necessary for entering the passage and the tidal streams run strong in it.

Mission.—The headquarters of the Roman Catholic mission is on this island. The mission has built a convent and a church.

Preserved provisions may be obtained.

About 300 tons of copra are exported annually. There are several trading stations on the island.

Coal.—About 200 tons of coal is generally kept in stock. It can only be shipped by boats. This supply can not be absolutely depended upon. It is always advisable to inquire from Sydney whether coal will be available before proceeding to these islands.

Tides.—It is high water, full and change, at 3h. 45m.; springs rise 6 feet.

Position.—The observation spot on Entrance Island is in latitude 3° 04′ 27″ N., longitude 172° 44′ 50″ E.

Current.—A current of 36 miles in 24 hours setting to the northwest has been experienced between Apaiang and Taritari Islands.

Little Makin, the northernmost of the Gilbert group, is situated on a coral reef 2¾ miles long, and varies in width from ¼ mile at the south end to 1 mile at the north. An anchorage is reported on the southwest side, but too close to the reef for anything but very small craft.

The landing is on the southwest side, near the village.

The island is fertile and well kept, with a fresh-water lagoon containing good fish. The population in 1901 consisted of 3 white men and 392 natives.

Ocean Island (Banaba or Paanopa) (lat. 0° 52′ S., long. 169° 35′ E.) was discovered from the *Ocean* in 1804; it is 6 miles in circuit, well wooded, and visible for a distance of about 25 miles. There is no harbor, but with the wind from the northward and little swell, a vessel might anchor on the spit extending from the southern villages, in from 7 to 10 fathoms, sand bottom, the island being steep-to around, with no known hidden dangers in the vicinity.

This island was annexed by Great Britain in 1901.

The center of the island is about 265 feet high and nearly flat, descending from the plateau fairly regularly to the coast. Cliffs from 12 to 30 feet high surround the island except in a portion of Home Bay, with reefs 100 yards wide all around. The reef dries at low water and has about 6 feet of water on it at high water springs. The climate though hot is healthful, and is tempered by a refreshing breeze.

The natives are a quiet, peaceable folk and number about 450.

There is a church in each of the four villages; the American board of missions has established a branch here.

Trade.—A large trade is done here in the export of phosphate by the South Pacific Trading Co. One hundred and forty-three thousand tons were exported in 1910.

The company have two stations, one at Ooma in Home Bay and one at Tapiwa, and moorings for their vessels (3 in Home Bay) have been laid down off these stations. There is no anchorage for large vessels, and the island should not be approached within 2 miles after dark.

The moorings in Home Bay are somewhat close to the shore. Those at Tapiwa are recommended, which are 300 yards from the shore in 60 fathoms; vessels using them must do so on their own responsibility. They badly want overhauling by latest report (1905).

Caution.—Vessels lying at the mooring buoys must put to sea when the signal U. D. C. is hoisted at the signal mast of the phosphate company.

Frequently two or three steamers are waiting off the island for cargo.

Supplies.—The distilling plant is capable of producing 4,000 gallons of water per day. The company has about 500 tons of coal in stock and will supply a vessel in case of necessity.

Winds.—Prevailing winds, April to November, northeast to southeast. Calms and dolrums from December to March with occasional gales from the west.

Current.—Usually sets fairly strong to the westward, but from December to March it frequently runs strong to eastward.

One observation showed an easterly current of 37 miles in 24 hours in August, 1905.

Tides.—It is high water, full and change, at 2h. 30m.; springs rise about 6½ feet.

Pleasant Island (Nauru) was discovered in 1798. It is about 12 miles in circumference and covered with coconut trees, being visible for a distance of 18 miles. On approaching it two round hummocks, some distance apart, are first seen.

A fringing reef extends 200 yards from the shore all around the island. There is neither harbor nor anchorage, the reef being steep-to.

Nauru is of coral formation and 100 feet high, apparently having been raised by volcanic action. The center is of much less elevation than the coast and contains a small fresh-water lagoon. The highest point on this island is a wooded hill on the west side, which is about 260 feet high. The island can be approached to a distance of 600 yards, as the shore reef is distinctly seen.

The works of the phosphate company, marked by a building with three iron chimneys, are situated on the western side and are lighted by electricity.

The mission station of Buschdorf is situated in the center of the island. There is accommodation for the sick in a bungalow. A doctor visits ship for a clean bill of health. Coconuts are extensively cultivated, and agents of European firms reside upon the west side of the island, where there is a bight in the coast and where the best landing place will be found.

During the prevailing northeast trade wind it is only possible to land on the west side. No bottom is generally found close to the reef.

Facilities.—One pier 500 feet long, belonging to the phosphate company, extends from the west side of the island.

Three mooring buoys are established off the outer end of the pier. Vessels should put to sea at earliest warning of bad weather. There are 16 lighters of 2½ tons each. Minor repairs in wood and steel can be effected; some castings can be made.

The current runs strongly to the westward past the island as a rule. Sailing vessels getting to leeward find great difficulty in making the island. It has been reported to run as much as 3 or 4 knots an hour. It is probably about half that amount, as shown by the current charts.

Pigs, fowls, coconuts, and bread fruit can be obtained, but fresh water is frequently scarce, consequent upon long droughts. Vessels trading to Nauru must "enter" at Jaluit, Marshall group.

The observation spot is in latitude 0° 32′ 54″ S., longitude 166° 55′ 00″ E.

CHAPTER X.

SCATTERED ISLANDS, NEAR THE EQUATOR, COMMONLY CALLED THE LINE ISLANDS.

Flint Island (lat. 11° 25′ S., long. 151° 48′ W.) (British), discovered in 1801, is 13 feet high, covered with brushwood and trees, and is visible from the masthead from a distance of 16 miles. It is about 2½ miles long north-northwest and south-southeast, ½ mile wide, is fringed by a steep coral reef which dries at low water, and extends seaward generally about 100 yards, but off the northern end of the island it extends seaward 900 yards and off the southern end in an east-southeasterly direction for 500 yards. In the interior are two small lagoons of brackish water.

The island was formerly leased when guano was shipped in some quantity. It was next leased for 21 years from November 29, 1885, for the cultivation of the coconut and the manufacture of copra; it is now leased for 99 years, from January 1, 1902, to Levers Pacific Plantation Co.

The possibility of obtaining anchorage off this island is entirely dependent upon wind and weather, and even under favorable conditions is not safe.

All provisions have to be imported, and as the fresh water is too brackish for consumption, rain water is used for all domestic purposes.

The island is furnished with houses, storehouses, saw pit, carpenter's shop, and boathouses; also with 2 miles of iron railway with trollies and a small jetty.

Shipment of copra was commenced in 1891.

Landing.—The landing place is on the northwestern side of the island where two reefs form a natural breakwater and where moorings are laid down and shipping operations carried on.

Winds and weather.—The following information was obtained from daily meteorological observations at Flint Island during the months of December, 1903, January, 1904, December, 1904, and January, 1905:

Mean temperature of December, 84° F.; mean maximum, 91½° F.; mean minimum, 76° F.

Mean temperature of January, 84½° F.; mean maximum, 91½° F.; mean minimum, 77° F.

Maximum during the period of 4 months, 100° F., on December 26, 1903.

Minimum during the period of 4 months, 61° F., on December 2, 1903.

Mean daily range of temperature for December, 15° F.

Mean daily range of temperature for January, 14° F.

Maximum daily range of temperature, 31° F., on December 2, 1903.

Minimum daily range of temperature, 5° F., on January 7, 1904.

Rain fell on 18 days during the whole period of observation and 84 days of clear weather were recorded.

Communication.—Sailing vessels from Tahiti call at Flint Island twice a year and a steamer belonging to Levers's Co. calls once a year.

There is little or no rise and fall of tide at Flint Island.

Vostok Island (lat. 10° 06′ S., long. 152° 23′ W.) (British) was discovered in 1820, and lies about 86 miles northwestward of Flint Island; it is somewhat triangular in shape and about 1,350 yards in diameter. This low sandy island is thickly wooded, about 80 feet in height to the tops of the trees, surrounded by a narrow fringing reef, with heavy breakers, and is visible from the masthead from a distance of about 16 miles.

Landing may be effected on the western side, through a boat passage in the reef, where there are some huts.

It is leased for 99 years from January 1, 1902, to Levers's Pacific Plantation Co.

Caroline Island (lat. 10° 00′ S., long. 150° 14′ W.) is an atoll about 123 miles eastward of Vostok Island. It consists of a number of small islands, standing on a coral reef surrounding a lagoon, the whole being 7½ miles long north and south, by 1¼ miles wide, and convex toward the eastward. The islets are said to be no less than 40 in number; they were taken possession of by Great Britain on July 9, 1868, and having been leased on the same terms and date and for the same purposes as Flint Island, are now similarly in possession of Levers's Pacific Plantation Co. for 99 years from January 1, 1902.

The island or group of islets thus formed is from 15 to 20 feet high, and may be seen from the masthead from a distance of about 14 miles. The inclosing reef fringes the shore, and on the outer edge the sea breaks with considerable violence.

The reef is reported to extend 1 mile from the southeastern point.

Pass.—The only pass through or over the reef is near the southwestern point; it is deep enough to permit ships' boats to enter the lagoon at high water.

Caroline Island was visited in May, 1883, by the U. S. S. *Hartford*, for the purpose observing the total eclipse of the sun. The transit pier used on the occasion is near the northern point of South Island, and is crowned with a marble slab bearing the following inscription: "U. S. Solar Eclipse Party. May 6, 1883."

Directions—Landing.—Pass southwestward or to leeward of the atoll and sight the flagstaff standing among the trees, near the transit pier. The flagstaff may be easily distinguished, and in the daytime a British ensign will probably be hoisted as the vessel nears the land. When the flagstaff bears 132°, if the vessel stands close to the reef, which is bold, the boat landing may be distinguished near the fluke of an anchor, just inside the surf on the reef.

The passage is formed by an indentation in the reef, about 50 feet deep, into which the boat must be pulled on the back of a roller. A sheer to port should be given to the boat when within the indentation to avoid some projecting coral rocks on the starboard hand; when this is passed a landing may be made on the flat coral reef. The reef does not dry at low water.

Supplies.—Several varieties of birds abound—curlew, plover, etc—and a few fowls. Fish are abundant and in great variety.

The source of fresh water is the rains, which filter through the sand and collect on the coral rock. There are two shallow wells on the southern and one on the northern island.

Climate.—The climate, though warm, is pleasant and the temperature equable. The weather, though mostly fine, is changeable, occasional sudden showers occurring, generally at night or early in the morning.

Winds.—The prevailing winds in April and May are from the northward and eastward. In 1878 a cyclone passed over the island, destroying most of the coconut palms.

Tides.—It is high water, full and change, at 4h.; springs rise 1 foot 7 inches; neaps, 5 inches. The lagoon is open to windward, and the rise and fall within is much affected by wind and swell.

Tongareva or Penrhyn Island (lat. 9° 00′ S., long. 158° 03′ W.), also locally known as Mangorongoro, is supposed to have been seen from the ship *Lady Penrhyn* in 1788, was formally taken possession of by the British naval vessel *Caroline*. It is now a dependency of the Dominion of New Zealand.

The atoll, situated about 325 miles to the westward of Vostok Island, consists of numerous low islets, about 50 feet high to the tops of the trees, connected by reefs surrounding a lagoon. The whole is about 12 miles long and 7 miles wide. All the islets are covered with coconut trees, many, however, without heads, which might indicate that a cyclone has swept over the islands. There is, however, no record of any such visitation, and the natives state that disease in the trees causes the heads to fall off.

Flying Venus Reef (lat. 8° 56′ S., long. 157° 54′ W.).—On September 6, 1889, the bark *Flying Venus* was wrecked on a sunken reef off the northeastern part of Tongareva atoll.

In 1896 the British naval vessel *Goldfinch* was informed that the reef is about 3 miles 53° from the North Pass, the natives, divers, etc., all stating that there are no other outlying dangers. In September, 1899, the British naval vessel *Pylades* anchored on the reef, found a depth of 3 fathoms, though there is probably less, and fixed the position of the center, from which the fishing huts on the northern part of the island bear 251°, distant 5 miles.

Anchorages.—There is a bank extending from the northwestern point, about 1½ miles to the northwestward, with from 7 to 9 fathoms, but shoaler water may exist. Anchorage might be obtained on this bank if necessary, but in a very exposed position.

There is fair anchorage outside the lagoon, just southward of the West Pass. The bank slopes gradually from the reef to a depth of 10 fathoms and then drops almost suddenly into deep water. The wind being nearly always from the eastward, a vessel swings outward, but it is said there is swinging room with a westerly wind, although the swell would then make the anchorage hazardous. The anchor should be dropped on obtaining soundings of from 7 to 10 fathoms.

The British naval vessel *Hyacinth*, during a stay of six days, twice drove off the bank to sea at this anchorage in 1893, and in the same year the British naval vessel *Ringdove* reported that with the anchor let go in 6 fathoms the observation spot bearing 81°, length of chain out not mentioned, there were 11 fathoms over the bows, 21 fathoms at the gangway, and no bottom with 25 fathoms over the stern.

Two conspicuous trees growing side by side close to the observation spot on the higher part of the reef form a useful mark when making for the West Passage anchorage.

Anchorage.—The best line to anchor on is reported to be the conspicuous red-roofed house on Tetautua (the eastern island), in line with the left of these two trees. It is advisable to go in dead slow to within 300 yards of the reef, till the water shoals, then back out, letting go the anchor with stern way in 8 fathoms. This will just give swinging room in 4½ fathoms, with two shackles of chain, and the anchor will lie about 15 yards inside the steep edge of the reef.

This anchorage would be uncomfortable in a westerly wind.

There are three passes into the lagoon, but the best is the West Pass.

The West Pass (lat. 9° 00′ S., long. 158° 03′ W.) is a break in the reef about 1,200 yards southward of Matunga or Molokai Islet. There is a rock in the middle with only 9 feet over it, between which and the southern side is a passage 40 yards wide with a depth of 15 feet, and all shallow water and rocks are clearly visible; but it is considered safe only at slack water, as the tide runs at a rate of 3 or 4 knots in this pass.

Inside the lagoon there is good, snug anchorage in the bay just beyond the Omoko settlement, in 15 fathoms, sand and coral, with plenty of swinging room. This anchorage is used by steamers calling at the island for more than a few hours.

The passage inside to the anchorage presents no real difficulty, as the shallow water is clearly defined.

Population.—The population in 1913 was about 400, including only one white man in addition to the resident agent.

There were only three lepers at Molokai in 1913.

Communication.—There is communication with Rarotonga about five times a year by schooner or mission steamer.

The Northwest Pass is northward of Matunga Island, opening out over the northwestern bank before described. It is reported to have a least depth of 22 feet, but this is doubtful, and it is very narrow and crooked.

The Northeast Pass is about 7 miles eastward of the northwestern extreme of the atoll and at the northern end of Tetautua, the eastern islet. It has a depth of 14 feet, but the tides run 5 knots through it. It is used by small craft trading with the settlement on Tetautua Islet, 1¼ miles southward of the pass, who generally enter by this pass but leave by the Northwest Pass.

The lagoon is studded with coral heads, distinctly visible, and there is room to navigate and anchor among them. Off Tetautua, within the lagoon, there is a patch of sand on which the trading schooners anchor in from 9 to 15 feet. The best shelter for vessels of any size from the prevailing trade wind is at the western anchorage already described, outside the lagoon.

Population.—In 1893 there were only two white men resident. The native population numbered at least 500, of whom about 250 reside at Omoko village, less than 1 mile southward of West Pass, the remainder being divided chiefly between Tetautua village, on the easternmost islet, and Tepuka, on the southeastern islet. In 1899 there were a few more white traders, but the total native population was given as 417. They appear to have come from different islands, their caste of features being very varied. They are reported to be of bold and resolute character, good sailors, and expert divers. They have Protestant missionaries among them and profess Christianity.

In 1900 the population consisted of 7 traders (French) and 450 natives.

Unfortunately leprosy exists at Penrhyn Island, and the islet Matunga, just northward of the West Pass, is used as a sanatorium (a "molokai," as the natives term it) for those suffering from this disease. They are kept strictly isolated, but are visited occasionally by a boat from Omoko. In September, 1899, the number of patients was 29, all suffering from the tubercular form of the disease, several being in an advanced stage.

Trade.—The natives in many cases own and sail their own trading schooners. The principal occupation of the islanders is the collection of pearl shell and coconut culture. Fish and coconuts can be obtained in abundance. About 30 tons of copra and from 35 to 45 tons of shell are exported annually.

Supplies.—Good bread was obtained in 1900.

Tides.—It is high water, full and change, about 6h.; rise, $1\frac{3}{4}$ feet.

Manahiki (lat. 10° 21′ S., long. 161° 01′ W.), or Humphrey Island, 190 miles southwestward of Penrhyn Island, was discovered in 1822. The British protectorate was declared and the flag hoisted on August 9, 1899. It is now a dependency of the Dominion of New Zealand.

It is an atoll of roughly triangular shape, with its apex to the north, and its southwestern angle very much rounded. It is 6 miles in length, northwest and southeast, by 5 miles at its greatest width, low, with a shallow soil, but densely covered with coconut trees, which reach to a height of from 60 to 70 feet and render it visible from a vessel's deck at a distance of about 12 miles. Other trees common to most of these islands do not flourish here.

The population in 1899 numbered 580, nearly equally divided between two villages. Their food consists chiefly of coconuts and fish. Great pains are taken to renew the coconut trees by replanting. Each family has a certain number allotted to them, and even the lagoon is partitioned out in the same way for fishing.

The chief is styled King Apolo, and, assisted by a missionary and council, governs fairly well. The people are well conducted and have two native teachers among them, sent from the mission at Rarotonga; many of the natives speak and write English. The principal village is on the western side of the atoll, and is fairly clean, neat, well built, and paved with coral; there is also a church and schoolhouse. The king exercises authority over the neighboring island of Rakahanga.

Anchorage.—There is no safe anchorage at any time. A temporary anchorage in 13 fathoms about 1,400 yards off the principal village has been used; here there would scarcely be room to swing should the wind fall light or from any cause the vessel tail inshore. There is no pass into the lagoon even for boats, but there is fair landing for a whaleboat opposite the center of the village, except from January to March, when westerly winds and unsettled weather prevail. Pearl shell is found here and appears to improve both in quantity and quality.

Seismic wave.—On February 7, 1899, a tidal, or more correctly a seismic, wave was experienced at this island, at Rakahanga, and at many others, doing much damage, many villages being washed away. At Manahiki it is said to have been seen approaching, having the appearance of a black wall of water.

Rakahanga (lat. 10° 02′ S., long. 161° 05′ W.), or Reirson Island, was discovered in 1820, and called Grand Duke Alexander Island. Reirson was the name given in 1822. The British protectorate was declared August 9, 1889. It is now a dependency of the Dominion of New Zealand.

It lies about 20 miles about north by west of Manahiki and is similar to it in appearance, but about half the size; it has a village church and school on the southwestern side, with native teachers; the natives number about 370, and appear to be very prosperous. They have a bank, the only one in these islands, managed on cooperative principles, and it has proved a great success. The soil generally is poor and shallow.

Anchorage.—Vessels can anchor off the northwest point of the island in a depth of 8 fathoms at 200 yards from the edge of the shore reef.

Landing is not very good, but can generally be effected either in a native boat or in a whale boat, with the assistance of the natives, who wade out into the surf and guide the boat through a narrow and winding fissure in the reef, about 670 yards northward of the village. No pearl shell is found here, though its introduction has been frequently attempted.

The missionary vessel of the London Mission pays periodical visits to this, as well as to many of the islands, where they have teachers established.

Suvarov or Suwarrow Islands (lat. 13° 15′ S., long. 163° 05′ W.) were discovered in 1814 and were decleared under the protectorate of Great Britain on April 22, 1889. They are now a dependency of the Dominion of New Zealand.

The group consists of several wooded islets on an atoll inclosing a lagoon, most of the islets being on the northern half. There is a good pass into the lagoon on the northeastern side.

Anchorage Island, about 80 acres in extent, is at the western side of this entrance; on it are the stores and buildings of the company, and all the inhabitants, who are employed as pearl divers and in the culture of coconuts, many thousands of which have been planted, some of which are bearing fruit, though the output of copra is at present very small.

The atoll is of irregular shape, but is about 8 miles long north and south, and also 8 miles wide; the reef is raised but very little above water, and is dangerous of approach on the southern or southeastern side unless the weather is clear. The northern part projects in a sharp point, on the eastern side of which are some islets covered with brushwood; Fanu Island, the northernmost, is 2½ miles northwestward of Anchorage Island.

The pass into the lagoon is on the northeast side of the reef, just eastward of Anchorage Island. Shoals of broken coral patches, some of which are awash, project westward from the southern or inner point of the eastern reef; but the reef extends very little distance from Anchorage Island.

The southern half of Anchorage Island has been reserved for the British Admiralty; the limits of this are indicated by boundary marks.

The top of the flagstaff, which stands on the base of the old wooden structure which has now been done away with, is 60 feet above high water.

In 1900 the population amounted to 32, belonging to many different islands. There is no spring or well on the island, and the inhabitants depend entirely on rain water for their supply.

There is good landing on the east side of Anchorage Island in Pylades Bay, close to the flagstaff.

There is a pier on the west side of Anchorage Island which is used for loading copra and pearl shell, but has only water alongside it for small boats.

The entrance, which should be approached with Anchorage Island bearing 189°, is between that island and the reef to the eastward of it.

Beacons.—A white triangular beacon stands on the southeastern edge of the reef extending from Anchorage Island.

A checkered black and white beacon formed by a cask on a staff is situated on the northwestern part of East Reef, which is awash at high water.

Two similar beacons are placed on South Reef 177° and 357° of each other and 124 feet apart.

Too much reliance must not be placed on these beacons, as they may be washed away by northwest gales which occur occasionally.

Directions.—With Anchorage Island bearing 189°, shape course toward the beacon on the East Reef when it bears 152°, which leads clear of a shoal of 2¼ fathoms off the west end of Northeast Reef, and continue on that course until the two leading beacons on South

Reef come in line bearing 177°, when steer for them. This leads through the channel with a least depth of 4¼ fathoms, but care must be taken not to open the beacons, as there are heads with only 3½ fathoms on them only just off the leading line. When the southern edge of Anchorage Island Reef bears 279° haul to the eastward, so as to pass the leading beacons on South Reef at a distance of about 150 yards, rounding South Reef at that distance, and steer for the anchorage.

Caution.—Vessels of 15 feet draft can use the channel between South Reef and Anchorage Island Reef, but caution is necessary.

Care is requisite to avoid being set across the channels by the tidal streams.

Tides.—It is high water, full and change, at 3h. 10m. (approximately). Springs rise 2 feet 3 inches, approximately. The tides are irregular.

Supplies.—There are a few fowls and fish are fairly plentiful and good. Coconut trees grow but do not bear well. Turtles are occasionally caught, and the eggs of the "wide-awake" are much used for food.

Danger Islands (lat. 10° 53′ S., long. 165° 45′ W.).—The group consists of three islands, named Puka Puka, Motukce, and Motukavata, with several smaller islets and sand cays, on and within an atoll 7½ miles long east and west by 4¾ miles wide at its eastern end, but much narrower and without islets at its western end. The atoll lies about 210 miles northwestward of Suvarov Islands and 390 miles northeastward of Apia Harbor, Samoa. It was discovered on June 21, 1765, and named the Danger Islands. They were formally annexed to Great Britain in 1892.

They are now a dependency of the Dominion of New Zealand.

Puka Puka, the northern island, 80 feet high and covered with coconut trees, is at the northeastern corner of the atoll and is the only one permanently inhabited, containing in 1902 a population of 480 souls, the chief, with the aid of a missionary, maintaining good order, and the people having a general well-to-do appearance. Motukavata attains a height of 125 feet and is long and low, rising in a lump near its southern end; Motukoe is wooded and about 100 feet high; there is a small cay at the northern end of it resembling a canoe under sail.

A church is on the west side of this island.

Caution.—The western side of Danger Islands should be approached with caution as a sunken reef extends, with an estimated width of about 600 yards, for a distance of about 3 miles in a westerly direction from Motukavata Island; it consists of detached patches with depths of 8 to 30 feet, none of which break in fine weather, and some of them not continuously in rough weather.

A sand cay, which had formerly served to mark the end of this sunken reef, was washed away by a tidal wave in January, 1914, and there is now nothing to indicate the northwestern limit of the shoal water.

The reef generally is extremely dangerous, both on account of its extent and of the strong current that sets westward on it. The lagoon is shallow with many dry patches and has no entrance even for canoes; there is deep water, close-to, on the outside. The only landing place (and that generally an impossible one for ships' boats) is on the western side of Puka Puka.

Trade—Supplies.—No hurricanes have been known to occur here. The soil is good and the products are limes, bananas, watercress, taro, and coconuts; about 60 tons of copra are exported annually. Fresh water might be obtained from Puka Puka for small vessels, by using native canoes, of which there are plenty, as well as two cargo boats. Fowls, ducks, and wild pigeons may also be obtained.

Tema Reef (lat. 11° 05′ S., long. 165° 35′ W.), 27 miles about north by west from Nassau Island, and about 14 miles southeast by south from Danger Islands, is 400 or 600 yards in diameter and breaks heavily, but has no rocks showing above water. At 1,000 yards northeastward of Tema Reef no soundings with 500 fathoms of line could be obtained, and all around the reef at a distance of 1 mile 100 fathoms of line failed to find bottom.

Nassau Island (lat. 11° 33′ S., long. 165° 25′ W.) was discovered in 1835 by an American whaler of that name, 45 miles about southeast by south of the Danger Islands. It is 1,400 yards in extent east and west by 1,000 yards wide, and is surrounded by a fringing reef, outside of which no dangers can be seen. The island was annexed to Great Britain at the same time as were the Danger Islands.

It is now a dependency of the Dominion of New Zealand.

Products.—The island has good soil and might produce many more coconut, banana, and other trees than at present; its highest part is at least 70 feet above the sea. The few inhabitants depend on the visits of trading schooners for provisions, but they have plenty of good water. Breadfruit, banana, taro, coconut, and lime trees all grow on this island.

Landing.—The best landing place is on the northern side of the northwestern point, but even with a smooth sea a boat is often unable to effect a landing, the swell being so great.

A sounding of 975 fathoms, sand and coral, was obtained 1¼ miles northeast by north of this island.

In 1899 the inhabitants consisted of only half a dozen natives, who collect and ship copra for the lessee of the island.

Victoria Island, the existence of which is very doubtful, is placed on the charts in latitude 6° 45′ S., longitude 160° 42′ W. No record of the original report of its discovery can be found.

The master of the British steamer *Wairuna* reports the existence of a dangerous reef, breaking heavily in a southeast swell, about 127 miles northwestward of the assigned position of Victoria Island in (approximately) latitude 5° 27′ S., longitude 162° 01′ W.

The captain states that the breakers were plainly visible several miles and appeared to be about 200 yards in extent in a southwest by west-northeast by east direction.

The vessel passed within 1½ miles of the reef and had it in sight 45 minutes.

NOTE.—The position must be considered approximate only.

Starbuck Island (lat. 5° 37′ S., long. 155° 56′ W.), discovered in 1825 and taken possession of by the British Government December, 1866, is about 235 miles northeast by north of Tongareva, better known as Penrhyn Island; it is 5½ miles long east and west, 2 miles broad, and about 15 feet high; it consists for the most part of white coral sand covered with green tangle and ice weed, with a few shrubs on the northeastern part, which render it visible from the masthead from a distance of about 11 miles.

Certain vessels are instructed to sight the island every 3 or 4 months, in case of shipwrecked crews being there. The beacon at the western end is about 25 feet high and painted red, with a notice headed "Starbuck Island" toward its base, facing south. The beacon was reported in good condition in 1913, and was visible from a distance of 12½ miles. The beacon is near the western point of the island, and is a large pyramid-shaped wooden structure, which was almost the first object seen from seaward.

Starbuck is surrounded by a reef extending 1,000 yards from the shore, except off the eastern end, where it extends farther. The northern and northwestern points are the only places where landing can be effected; here there are passages through the reef, but landing is difficult and dangerous at all times.

The island has, at various times, been worked for guano, then abandoned, and is now uninhabited.

Near the northwestern point, close to the shore, the depth is 15 fathoms, and less than 100 yards farther out, the descent is from 15 to 130 fathoms and upward; anchorage off the southern side is wholly impracticable.

Current.—On the occasion of the loss of the French transport *Euryale*, on the night of March 10, 1870, the current was stated to have set 50 miles 295° in 24 hours.

The approach to Starbuck and also to Malden Island, especially from the eastward, should be made with great caution, owing to the prevalence of this current, as well as to the fact of a large portion of the reef being awash and to the dangerous prolongation of the reefs of both islands in an easterly direction.

Malden Island (lat. 4° 03′ S., long. 155° 01′ W.) (British) was discovered in 1825. It has been for many years leased for working the guano.

It lies about 106 miles northeast by north of Starbuck Island, is a low coral island of triangular form with apex to the westward, about 5 miles long, and 4 miles broad at the eastern end, and in no place more than 30 feet above the sea; a few shrubs and marine plants grow on the island, which render it visible from the masthead from a distance of about 15 miles.

Water.—No fresh water is to be found, though repeated attempts have been made to obtain it by sinking wells. In 1902 two large tanks were placed underground, and were full of water, sufficient to last the inhabitants for two years.

The settlement is at the western end of the island. In 1913 there were 4 Europeans and 50 natives on the island, but no women or children. The export of guano for 1900 was 10,000 tons. A tramway brings the guano from distant parts of the island to windward: the trucks are pushed up by hand in the morning and sail back as they are loaded. Houses, stores, carpenters' and blacksmiths' shops, tram pier, boats, etc., are maintained in good order.

There are several salt lagoons on the island, one of large size, the waters of which ebb and flow with the ocean tide. Indications of former inhabitants exist.

Communication is maintained with the adjacent islands and with New Zealand, by means of schooners of about 350 tons.

Climate—Rainfall.—The climate of Malden Island, as shown by a register kept from March, 1890, to March, 1894, is remarkably equable. The mean height of the barometer for that period was 29.864, and the extreme range only 0.3 of an inch. The average maximum day temperature was 91.75°; only once did it reach 99°, and it was never less than 89°. The rainfall averaged 8.33 inches per annum, falling on 53 days, but it differs considerably in different years, viz, from 5.73 inches falling on 48 days in 1890, to 11.74 inches, on 63 days, in 1892.

Winds.—Gales and fogs appear to be equally unknown and the trade wind blows with great steadiness, as shown by the following table:

General direction of wind from March, 1890, to March, 1894.

	North.	North-east.	East.	South-east.	South.	South-west.	West.	North-west.
Number of days or parts of days on which the wind blew from point indicated	38	205	1,138	51	1	0	3	5

Anchorage.—The island is steep-to, with but an indifferent anchorage on the lee or western side; a boat pier extends under sheers, from which cargo boats are loaded. A swell setting from the northwest point makes landing at the pier difficult.

Moorings are laid down off the western side of the island in deep water, about 80 to 100 fathoms, and although close to the beach are considered secure and allow swinging room. The utmost caution is necessary when approaching them under sail, especially as the current generally runs strongly to the southward. It is advisable to keep some after-sail set aback when at the moorings, to prevent tailing on the reef should the wind fall light, or else drop a small stern anchor in about 60 fathoms.

Nos. 1 and 2 mooring buoys are secured with 2-inch chain, and 2¼ inch at the anchor.

There are two small buoys available for small craft, lighters, etc., only, about halfway between No. 1 buoy and the loading pier.

Signals are made from a flagstaff to indicate the buoy to be taken; a flag at the starboard (from seaward) yardarm meaning the southern buoy, No. 1; at the port yardarm the northern, No. 2.

A small ledge extends a short distance from the shore just southward of the pier. Care is necessary in giving this ledge a wide berth, as the current sets right across it.

Landing is effected at the loading pier or on the beach when the surf permits.

Current.—A strong westerly current must be expected and taken into consideration when navigating in this vicinity. It runs very strongly between Malden and Starbuck, generally to the westward about 32 miles in 24 hours: and in the vicinity of the latter island it has been estimated to run 43, 51, and even 56 miles to the west-southwestward in 24 hours. But in October, 1887, a northeasterly set of 17 miles was experienced near Malden Island, so that great care is requisite and a constant resort to astronomic observations to check a vessel's position, as it is evident that implicit reliance can not be placed on the set being always westerly.

Filippo Reef (lat. 5° 31′ S., long. 151° 49′ W.).—The master of the Italian bark *Filippo* reported that, on June 28, 1886, the weather being fine and clear, with a light breeze, he passed a reef which he estimated to be about 1 mile long northwest and southeast, and less in width. From the appearance of the breakers on the reef it has only 2 or 3 feet water over it.

Jarvis Island (lat. 0° 22′ 30″ S., long. 160° 03′ 00″ W.), supposed to have been discovered by the ship *Eliza Francis* in 1821.

It lies about 365 miles northwestward of Malden Island; it is a small coral island about 1¼ miles in extent east and west, and 1¾ miles north and south on its western side, but only 1 mile in that direction on its eastern side; it appears as a white sandy beach, 10 or 12 feet above the sea, without trees and almost without shrubs, and but few patches of grass; it may be seen from the masthead from a distance of about 14 miles. There is no anchorage.

The island has large deposits of guano, and shows unmistakable signs of having been raised by upheaval; the lagoon has discappeared and its bed is 7 or 8 feet above the sea, with many marks indicating the gradual retreat of the waters.

Landing is effected through a gap in the reef on the northwestern side, where, with the wind east, there is no difficulty in getting on shore.

A shoal bank extends about 1 mile from the northeastern point of the island, on which the least water obtained was 5 fathoms. A bank also extends from the southwestern point.

Christmas Island (lat. 1° 57′ N., long. 157° 28′ W.) was discovered on Christmas Day, 1777.

Aspect.—Christmas Island is about 200 miles northeast by east of Jarvis Island, is one of the largest of the coral islands, being 40 miles long on its northern side and 35 miles long on its southern side, with an average width of 35 miles. The highest parts are near the northwestern and southwestern points, where the height of the beach and the scrubby growth of coconut and other trees renders it visible 12 miles from a vessel's deck.

Caution.—At the eastern end, where it is quite barren and does not exceed 3 or 4 feet in height, it is not visible more than 5 or 6 miles from the deck, the haze of the breakers being often seen before the land. This, together with the strong current generally setting to the westward, particularly at full and change of the moon, render the eastern side of the island extremely dangerous, and many wrecks have occurred upon it. A sailing vessel getting embayed in the deep bight formed between East and Southeast Points at night has but a poor chance of getting out again after discovering the breakers.

Attention is called to the current, which has 10 to 60 miles a day westerly set in the vicinity of this island.

The winds are generally from the eastward, with an occasional squall from the northward or southward. Rain squalls during the night are frequently experienced near the time of full moon.

The coast line of this island is reported to be inaccurately delineated on the chart.

Beacons.—Two beacons have been erected on this island, one on East Point and another on Southeast Point.

That on Southeast Point is an iron conical beacon painted dark red and surmounted by a pole, the top of which is 45 feet above the ground and 65 feet above high water. It has been erected about 1 mile from the eastern extremity of the point.

A cairn has been erected at the Northwest Point, where schooners now find anchorage and good landing for the coconuts which are being planted on the island.

Passes.—On the western side of the island is an indentation, with Cook Island, 10 feet high, a sandy island lying in the center, between each end of which and the shore are narrow shallow passes into the lagoon. Small vessels may enter by either of them, but the lagoon itself is also very shallow and studded with coral rocks, making its navigation difficult even for boats, and the sea breaking over the low belt of coral makes anchorage inside very inconvenient.

Anchorage—Directions.—There is good anchorage, quite out of the current, with the flagstaff at the settlement bearing 96°; northeastern tangent of Cook Island 169°; and the two beacons, situated about 200 yards northward of the flagstaff, in line bearing 79°.

Stand in with the beacons in line, and anchor when in 12 fathoms. The flagstaff shows distinctly, but the beacons do not show well when approaching from the northward, on account of the background of bushes, until the anchorage is neared, when they become plainly visible.

There is fair anchorage between 600 and 800 yards off Cook Island in from 10 to 15 fathoms, and the water is generally smooth. The tides set strongly in and out of the lagoon, but are not much felt at this anchorage.

Landing, etc.—The settlement, such as it is, is on the northern point of the northern pass, and the best landing is round the point inside the lagoon abreast of the houses. Some care is required to keep clear of coral heads, and there is often a good deal of swell in the entrance.

Supplies.—Fish are plentiful, of excellent quality, and easily caught by heaving a line a few feet from the beach at high water. A few turtle have been seen and sharks are numerous, giving much trouble to the shell divers.

Water.—The water supply is very uncertain, depending upon rainfall. An inferior quality of decidedly brackish water is found by digging shallow wells; it answers for cooking purposes and would sustain life for a short time.

The wood of the bushes growing on the island is extremely soft, spongy, and of but little value. The coconut trees, which early visitors reported, nearly all disappeared, and though many attempts at replanting have been made, comparatively few now exist, though the export of copra is said to be again on the increase.

The island is under lease for 99 years from January 1, 1902.

There were no inhabitants on this island in 1908. There is no regular communication with the island.

Tides.—It is high water, full and change, at 4h. 23m. Springs rise 3 feet 2 inches.

Fanning Island (lat. 3° 51′ N., long. 159° 22′ W.) is an atoll inclosing a large and for the most part a very shallow lagoon. It was discovered in 1798. It lies about 145 miles northwestward of Christmas Island and is thickly covered with coconut trees from 60 to 90 feet high, which render it visible from a vessel's deck at a distance of about 15 miles.

Aspect.—The greatest length of the atoll is 9½ miles northwest and and southeast by 4 miles wide; it is not above 2 or 3 feet high in any part except along the outer coast line for the greater part of its length, where a raised rim of coral has been thrown up by the sea to a height of about 10 feet in places. This rim forms a kind of breakwater on its northern and eastern sides.

On all sides the edge of the reef is steep-to at from 100 yards to 200 yards from the shore, the 100-fathom line encircling the atoll at about 500 yards from the shore, except on the northern and northwestern sides, where it is about 1,000 yards from the shore, and in this part the plateau of soundings is of sufficient width to permit of anchorage in from 13 to 20 fathoms with sufficient swinging room to clear the reef.

The width of the coral belt inclosing the lagoon, almost entirely occupied by fertile islands, is nowhere more than 1,500 yards. There are several gaps in the trees, which appear from seaward like passes into the lagoon but are not so, the only ship entrance being English Harbor on the southwestern side. On the eastern and northeastern sides are several canoe passes through the reef, but they can only be used in the finest weather.

Produce.—Guano of an inferior quality was formerly exported, vessels loading at Whaler Anchorage, but the guano has either been worked out or has ceased to pay, and that settlement has been abandoned. Pearl oysters, of rather small size, are found in the lagoon and are a source of profit. Considerable quantities of copra, but much less than in former times, are exported annually, a schooner from Honolulu calling, as a rule, twice a year both at this and at Washington Island.

Coal and supplies.—In December, 1902, there were 350 tons of coal in stock, but it is difficult to get on board. The only method of doing so being a scow capable of carrying 5 or 6 tons. Poultry can always be obtained, and cattle occasionally. The well water is good and plentiful and a reserve of 8,000 gallons of rain water is kept in tanks.

Snipe, duck, and curlew can be shot, and land crabs are in abundance. Fish of excellent quality abound in the lagoon, and there is a good beach for hauling the seine near the settlement.

The population in 1901 consisted of one European and 46 Gilbert Island natives engaged in collecting copra.

Telegraph.—The cable between Suva and Vancouver Island, which was completed in November, 1902, is landed at this island.

Whaler Anchorage.—On the northwestern side of Fanning Island, 3½ miles northwestward of English Harbor and opposite a small indentation in the coast, is this anchorage, in from 10 to 20 fathoms about 500 yards offshore.

Vessels must anchor northward or southward of the limits of prohibited anchorage.

Beacons.—Abreast of the anchorage is a boat channel through the fringing reef to the beach.

Two white posts, about 25 feet high and surmounted by diamond-shaped top marks, are situated 200 yards northward of the pier; these beacons are in line when bearing 119°.

A conspicuous tree is situated 150 yards north-northwestward of the beacons.

The beacon marking the boat channel and that at 200 yards northward of the pier do not exist.

Pier.—At low water the sand uncovers beyond the outer end. A tramway runs from the outer end to the telegraph buildings in the rear; a rifle range is situated about 300 yards southward of the pier.

Buoys.—The mooring buoy is situated 600 yards northwestward of the pier and a small can buoy marking the boat channel at nearly 200 yards northwest of the pier.

This anchorage is useful if waiting tide to enter English Harbor, and landing can almost always be easily effected. The 20-fathom line is about 60 yards outside this berth, and from thence the depths increase rapidly.

Light.—When a vessel is expected a light is exhibited from the flagstaff at the root of the pier.

Prohibited anchorage.—Vessels are prohibited from anchoring over a space defined on the north by the beacons in line bearing 119° and on the south by the flagstaff bearing 92°.

English Harbor.—The entrance to the lagoon is nearly 300 yards wide between Danger Point, on the northern side, and Weston Point, on southern side, but a reef drying in patches extends halfway across the channel from Danger Point, and another a short distance from Weston Point, reducing the navigable width, with more than 20 feet water, to less than 100 yards. In best water there are from 4 to 6 fathoms.

Tidal streams.—The tides run upward of 5 knots in the narrowest part, and, though both flood and ebb streams set straight through, vessels should not attempt the passage except at or near slack water. On the ebb there are tide rips and overfalls extending from the spit on the northern side to near the center of the channel, which might at times be dangerous to boats.

A bearing of Weston Point is the best guide either in entering or quitting English Harbor, but vessels should not enter without a pilot, who will come off from the settlement on the eastern side of Weston Point, where there is a flagstaff. Though a good harbor for steamers, the prevailing winds make it an unsafe place for square-rigged sailing vessels to enter; fore and aft rigged vessels, with a knowledge of the tides, may work in.

Anchorage.—The best and only safe anchorage for vessels of more than 13 feet draft is immediately within the entrance points off the settlement in 4 or 5 fathoms water and in the full strength of the tide; here a vessel 250 feet long, and moored, has barely room to swing. There is an inner and spacious anchorage with 7 or 8 fathoms, where vessels might lie at single anchor; but to reach this anchorage, a bar 600 or 800 yards wide with only 12 to 15 feet water has to be crossed, which at present makes it an impossible anchorage for any but small craft. There is very little tide at this inner anchorage, and there is no doubt that, if required, a moderate amount of dredging and blasting would convert it into an excellent harbor capable of accommodating many ships. The holding ground is indifferent.

If mooring at the entrance to English Harbor, it is advisable to do so with open hawse to the southward.

Directions.—A steamer of 16 to 18 feet draft may enter safely with the beginning or end of the ebb, and moor opposite the houses as directed. In entering, Weston Point should be steered for bearing 62°; this clears the shoal extending southward from Danger Point, after passing which, Weston Point may be passed at a distance of about 50 yards. There is a narrow eddy on the flood on the southern side just inside Weston Point. If practicable, it would be well before entering to anchor a boat or place a buoy on the edge of the shoal water extending 400 yards southwestward from Weston Point.

The best time for leaving the anchorage is at the beginning or end of the flood tide.

With the exception of, and beyond, the inner anchorage described, the lagoon is choked with coral bars and patches, said to be growing up; there are, however, some deep places. Small vessels may lie alongside the eastern shore out of the tide.

Jetty.—An iron jetty, formerly at Whaler Anchorage, is now erected at the settlement at English Harbor between Weston and Kitty Points. Vessels of 18 feet draft can load alongside, but breasted off about 30 feet; the ebb tide alone will be felt in this position, and it runs at an extreme rate of 1½ knots only.

Meteorology.—From observations made by the Pacific Cable Co. at Fanning Island during the five years 1903–1907 the following results are obtained:

Mean temperature of year, 81.5° F.; mean monthly maximum, 85.1° F.; mean monthly minimum, 77.4° F.; mean daily range, 6.3° F.

Maximum temperature for whole period, 92° F., in November, 1904.

Minimum temperature for whole period, 73.5° F., in February, 1907.

Maximum monthly range, 9.9° F., in August, 1906.

Minimum monthly range, 2.5° F., in November, 1903.

Rainfall.—The mean annual rainfall is 135 inches and the mean annual number of days on which rain fell 125.

Rain fell during every month except August, 1906, the latter part of the year being generally the driest season.

The maximum monthly rainfall of 53 inches occurred in April, 1905, and the maximum daily rainfall of 7 inches on December 14, 1904.

Winds.—During the year northeast winds prevailed on an average for 40 days, easterly winds for 114, and southeast winds for 150; calms averaging 28 days during the year.

Barometer.—During the year 1907 the mean barometric pressure was 30.024 inches, and the mean monthly range 0.156 inches.

Water may be procured by digging wells, in which the fresh water rises and falls with the tide; these wells should not be more than 4 feet deep or the water becomes brackish.

Communication.—The steamers of the Union Co. call at Fanning Island bimonthly.

Tides—Tidal streams.—It is high water, full and change, at 6h. 15m.; spring rise 2 feet; neaps range 6 inches. The flood stream runs for 10 minutes after high water, the ebb for 20 minutes after low water; the flood at from 4½ to 5 knots, the ebb at about 3½ knots, but both are much affected by the force and direction of the wind. During neaps, though the streams are not so strong, the difference is not nearly so great as might naturally be expected.

Washington Island (lat. 4° 43′ N., long. 160° 25′ W.), also called New York Island, lying 75 miles northwestward of Fanning Island, was discovered in 1798.

It is 3½ miles in length, east and west, by 1¼ miles wide, the height above the sea about 10 feet, and with the exception of the area occupied by a fresh-water lagoon 1½ miles long in the eastern part of the island, it is entirely covered with a most luxuriant growth of coconut and other trees, which render it visible from the masthead from a distance of about 14 miles. The village is at the western end of the island. The lagoon water is unwholesome, and it is stated that the natives have contracted Bright's disease from the use of it.

Products.—There is guano on the island, but it is not worked. The soil is very rich, and all kinds of tropical fruit and vegetables flourish.

The fringing reef extends 1,000 yards off the eastern point and for some distance around the northeastern side. At the western end two tongues of reef extend between 600 and 800 yards from the shore. In all other parts the edge of the fringing reef is close to the shore, but at the western end a bank, deepening very gradually, extends a long way to the westward, there being only 14 fathoms at 2½ miles from the land.

Caution.—When approaching Washington Island every opportunity should be taken to verify the position of the ship, for, being near the southern edge of the counter equatorial current, great variation, both in direction and strength of current, may be expected.

Anchorage.—The bank described, extending from the western end of the island, affords good but very exposed anchorage in any depth from 7 up to 17 fathoms. It has been found an uncomfortable anchorage with a strong westerly current setting the ship up broadside to the sea caused by the strong northeast trade.

The anchorage off the western end of the island at about 1,200 yards from the shore has been found a very uncomfortable anchorage.

There are many deep holes here in which vessels have lost their anchors. A sandy bottom should be selected before letting go nearer the island.

Population.—There were 96 men and women and 42 children on the island in 1901. The men were employed in collecting coconuts.

Flagstaff.—There is a flagstaff about 100 yards north-northwest of the observation spot.

Landing is nearly always dangerous and sometimes impracticable on account of the heavy surf. The old landing place is at a small gap between the two spits of reef at the western end, but a new landing has been made in the reef about ½ mile eastward of the old landing place, where there is, as a rule, much better landing; but it has the disadvantage of being some distance from the anchorage.

Palmyra Island (lat. 5° 52′ N., long. 162° 06′ W.) is an atoll, discovered by the American ship *Palmyra* in 1802. It was taken possession of by the United States and became a part of the Territory of Hawaii in 1912. It lies about 120 miles northwestward of Washington Island, and consists of many small islets occupying a space of 5½ miles east and west by 1½ miles north and south.

Aspect.—The atoll incloses three distinct lagoons, each having 20 fathoms water and upward, but without openings or passes, even for boats. The islets are low, the highest being only 6 feet above the sea, and covered with bush and coconut trees; the latter, being from 60 to 100 feet high, render them visible from a ship's deck at from 12 to 15 miles. From a distance the islets appear to form a group surrounding a single lagoon.

The coral reef extends 1¼ miles eastward of Portsmouth Point, the eastern extreme of the group of islets, and at its termination it is broken up into a number of detached patches. The bank, however, extends fully 3 miles eastward from Portsmouth Point, with apparently from 4 to 6 fathoms, but the heavy blind rollers, breaking occasionally, render it impossible to do more than define the edge of this bank, which falls down very steeply to upward of 100 fathoms, the lead giving no warning of approach to danger. With Portsmouth Point bearing 282° 1.6 miles, a depth of less than 3 fathoms has been found.

Strong and variable currents may be expected and should be guarded against.

There were no inhabitants in 1897, but traces of former inhabitants who occupied Strawn Island are said to exist; and such traces were also found on Observatory Islet, the southwestern islet of the group.

West Bank and reefs.—Westward of the islets a bank nearly 2 miles wide in the center extends westward nearly 4½ miles; it has a ridge with from 6 to 8 fathoms on its southern side, from 7 to 10 fathoms around its western end and northern side, and from 7 and 8 to 14 and 15 fathoms in the center. Outside the ridge the soundings everywhere descend with a steep gradient to depths of 100 fathoms and upward.

The drying reef at the western end of Palmyra Island is fronted for a distance of 1 mile by such a mass of small coral heads, some awash, some with a foot over them at low water, that it is almost impossible for even a skiff to find her way among them. Westward of this mass of rocks the water suddenly deepens to from 4 to 8 fathoms and offers excellent anchorage.

Anchorage.—It is dangerous to approach the anchorage at Palmyra Island either from the northward or southward, on account of the shoal water extending nearly 2 miles westward from Sawle Point on the northern side and nearly a mile from Penguin Spit on the southern side. The safest approach is from the westward. The best anchorage for a vessel of 18 feet draft or more is in 8 fathoms, sand and coral, with Sawle Point bearing 69°, distant 2 miles, and Penguin Spit 114°.

Landing is bad at low water on account of the innumerable coral heads. The best landing is on the northern side of Penguin Spit. At high water a skiff can just manage to float over the reef into the western lagoon.

Wind and weather.—It has been stated by a former resident that during the five months he had been on the island the rain was almost constant, four days of dry weather being the longest interval on any one occasion. There is no evidence that the island is visited by storms, but strong squalls sometimes blow from east and southeast. During the stay of the British naval vessel *Penguin*, in the latter half of May, the wind was generally from northeast to east-southeast light to moderate. Not much rain fell during that time, nor up to the middle of June while the ship was still in that vicinity.

Supplies.—Fish are abundant and in great variety; turtle scarce; curlew, snipe, and plover were found, and land crabs abound. On one of the eastern islets is a small pool which generally contains rain water.

Tides.—It is high water, full and change, at 5h. 5m.: springs rise 3 feet, neaps range 1¼ feet.

Kingman Reef (lat. 6° 23′ N., long. 162° 18′ W.).—In June, 1874, the British steamship *Tartar* struck on this reef, which having been surveyed by the British naval vessel *Penguin*, in 1897, is considered to be without doubt identical with Caldew Reef, Maria Shoal, and other imaginary dangers reported from time to time in the vicinity, which, after an exhaustive search by the *Penguin*, have been removed from the charts.

Aspect.—Kingman Reef lies 33 miles northwestward of Palmyra Island; it is of atoll character, of triangular shape, with base to the southward and apex to the northward. Within the 100-fathoms line, it is 9½ miles long east and west by 5 miles north and south. It dries at low water on its northeastern, eastern, and southeastern edges: at the western extreme is a patch of 4 fathoms, and possibly less, on which the sea breaks occasionally. The remainder is encircled by a ridge with from 4 to 10 fathoms, within which the depths are from 14 to 45 fathoms. Outside the ridge the bank falls suddenly to depths of 300 and 400 fathoms.

Current.—Kingman Reef is within the belt traversed by the counter equatorial current setting eastward, which current in this part attains a strength of from 30 to 42 miles a day.

Diana Shoal was discovered by a schooner of that name in 1852 on her passage from Honolulu to Fanning Island. The position given was latitude 8° 40′ N., longitude 157° 20′ W., but a depth of 2,860 fathoms has been found at this spot, and soundings in the vicinity gave depths of from 2,600 to 2,950 fathoms generally. In 1863 the British naval vessel *Hecate* searched unsuccessfully for the shoal in the above position, but was informed afterwards at Fanning Island by an English trader that it is well known to exist and is of considerable extent. It is not shown on the charts; but, under these circumstances, its existence must be considered as possible, though very doubtful. It has never again been reported, and, if existing, the position given was certainly wrong.

Reefs.—The schooner *Honolulu* reported in 1901 the existence of a reef in latitude 7° 33′ N., longitude 153° 42′ W., and breakers at ¾ mile northwestward of that position.

A reef has been reported by whalers and is shown on the chart in latitude 10° 0′ N., longitude 179° 30′ W. Its position requires to be established, if existing, and in the meantime it also is marked "doubtful."

Reported breakers.—The master of the French bark *Michelet* reported that on January 18, 1907, his vessel passed within 200 yards of an area over which the sea was breaking in approximately latitude 22° 10′ N., longitude 131° 06′ W.

The weather was clear and good observations were obtained.

No soundings were taken.

Breakers reported (bark *Michelet*, 1907) is placed on the chart in the above position and marked "P D."

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